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Journal

OF THE

Royal Army Medical Corps

EDITED BY

COLONEL SIR WILLIAM H. HORROCKS, K.C.M.G., C.B.

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LIEUTENANT-COLONEL A. E. HAMERTON, C.M.G., D.S.O., R.A.M.C.

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Journal of the Royal Army Medical Corps.

Original Communications.

THE EVACUATION OF THE SICK AND WOUNDED ON THE NORTH-WEST FRONTIER OF INDIA.

By CAPTAIN E. B. MARSH, M.C.
Royal Army Medical Corps.

(*Continued from p.* 415, *December* 1923.),

Since the Waziristan Operations of 1919-20 the Indian Hospital Corps has been organized, and although it does not strictly speaking concern this narrative, a brief reference to it may be of interest as its formation will affect the medical service in future frontier wars. The idea of combining into one organization the Army Bearer Corps, the Army Hospital Corps and the subordinate personnel of Indian Station Hospitals existed for a number of years, but the question was not seriously taken up until 1901 when a committee suggested the adoption of the scheme. The matter was apparently dropped owing to the war and was not again taken up until 1917, when a detailed proposal was submitted by the Government of India to the Secretary of State. Owing to the termination of the Great War the scheme had to be altered in many details, and it was not until June, 1920, that final sanction for the formation of an Indian Hospital Corps was accorded by the Secretary of State. Since that date the new Corps has been organized and is in working order.

The Corps is divided into ten companies approximately corresponding to the military districts in India and Burma. Each company consists of four sections :—

(1) Company headquarters, in which are included clerks and store keepers.

(2) A nursing section which absorbed the Ward Orderlies of Indian Station Hospitals.

(3) An ambulance section which absorbed the Army Bearer Corps.

(4) A general section, which absorbed the then existing establishment of cooks, ward servants, dhobies, &c., of British and Indian station hospitals.

It is clear from the above that the Indian personnel of any medical unit mobilized for field service will be drawn from the Indian Hospital Corps. The clerks, storekeepers and men of the nursing and ambulance sections are enrolled and attested, and those of the general section enrolled only. The attested sections are clothed and equipped on the same scale as combatants and the enrolled section on the same scale as followers, all sections are supplied with free rations. These changes in the status of the men should make it more practicable in the future to provide trained and disciplined personnel for field medical units, and the ambulance section if suitable recruits are obtainable should compare favourably in appearance, soldier-like manner and bearing with the infantry of the Indian Army.

Special stress has been laid on the importance of enlisting high caste men for bearers, because it is considered a highly important factor when dealing with Indian fighting troops, for if low caste men are employed the rank and file of the fighting formations will look down upon them and, when patients in field medical units, will not carry out orders issued to them by the bearer N.C.O's.; nor can the officer commanding the particular field medical unit reinforce the nursing orderlies, should the necessity arise, by bearers, because the patients would not accept food or water or in some cases even allow themselves to be touched by men of an inferior caste. The ideal, therefore, is to enlist as high a percentage of kahars as possible and for the remaining men to be high caste Hindus or Mohammedans, the proportion of Hindus and Mohammedans depending on the relative number of each in the Indian Army.

In this connexion it is important to remember that a Mohammedan of good family will accept food, etc., from a Hindu of high caste but not vice versa. The class of men enlisted is a matter of outstanding importance and one which affects the efficiency of Indian medical units to a marked degree. Whether the type of man required can be obtained in future on the initial pay of rupees ten a month is still a matter of speculation. Even after the experiences of the Great War it is not an uncommon idea amongst certain sections of the public, and indeed some in official positions who have not seen the workings of armies on active service, and who therefore have neither seen the sick and wounded on the battlefield nor had the misfortune themselves to be disabled by enemy fire or smitten down with acute illness during active operations, that stretcher-bearers and other personnel of medical units may be drawn from a much inferior social type than the fighting soldier.

It was suggested that the rates of pay for stretcher bearers and nursing orderlies should not be more than that received by mule drivers. That seems strange in the light of the experiences gained in previous wars, and it is hardly understandable that a man who is directly responsible for the

care of sick and wounded soldiers should be compared with a man who grooms and feeds a mule and cleans its harness. In private life a syce is not paid as much as a bearer, the latter usually receives more than a third as much again.

The lives of both British and Indian soldiers, wounded or sick, in time of battle depend on the efficiency of the medical personnel employed, from the most senior ranks concerned down to the sweeper, and it may truly be said that any one man, or body of men, who neglects to profit by the advice of experienced soldiers, whether medical men or otherwise, may indirectly be the cause of untold suffering and even death to many hundreds of men. Historical facts, one or two of which have been quoted, have proved this; history repeats itself, but it should be the aim of all who are concerned with the welfare of the British and Indian soldiers to see that in this particular instance history shall not be repeated. This subject is therefore deserving of the greatest consideration and deepest thought on the part of all who have it in their power to make or mar the Indian Hospital Corps.

The method employed for carrying stretchers during the operations upon which this narrative is based will be referred to later.

(2) *Ambulance Ponies.*—To each field ambulance forty-two riding ponies were attached and to each combined staging section fifteen riding ponies. The ponies were intended for slight cases whether wounded or sick, but were not really a very great success. They averaged a little under thirteen hands in height and in the majority of cases had been selected with care.

Surgeon Major-General T. Maunsell, C.B., in his report[1] of the Medical History of the Chitral Relief Force of 1895, states: "As transport for sick, riding mules were given to some hospitals, ponies to others; of the latter all were unbroken, and as many as 20, 30 and even 40 stallions were given to field hospitals. The latter gave great trouble, and could not be ridden or managed even by men in health." The type of animal required is of moderate size capable of enduring much fatigue. Neither high mettle, showy action, nor speed are wanted for ambulance ponies. A tractable and equable temper and a steady and regular gait are essentials. The class of animal just described is not easily obtained and therefore those responsible for providing these ponies need a knowledge of what is required.

The patients in the Derajat Column were carried on ordinary saddles which meant that the invalid had to exert a certain amount of energy to preserve his seat and also necessitated the head and trunk being in the erect position, both of which are liable to induce faintness in persons of weakened health. These disadvantages were much magnified in the case of Indians, none of whom had ever in their lives before sat on a pony.

Another disadvantage was the difficulty experienced in keeping the hoofs in a healthy condition.

The air in this locality is very dry, especially in the winter, and was the

[1] A.M.D. Report for 1896, page 361, Section 98.

cause of the hoofs becoming brittle. This resulted in cracks which made shoeing difficult, and owing to the rough, stony nature of the ground shoes were essential. Finally, it might be remarked that the Indian has a rooted objection to sitting up at any time if he can lie down and patients used to implore one not to send them down the line on ponies.

(3) *Camels and Kajawahs.*—Camels were the main form of carriage for transporting the sick and wounded. The dromedary or one humped species is the one always used. The Bactrian, two-humped or true camel is rarely met with in India, but is occasionally seen on the north-west frontier when caravans arrive from Afghanistan.

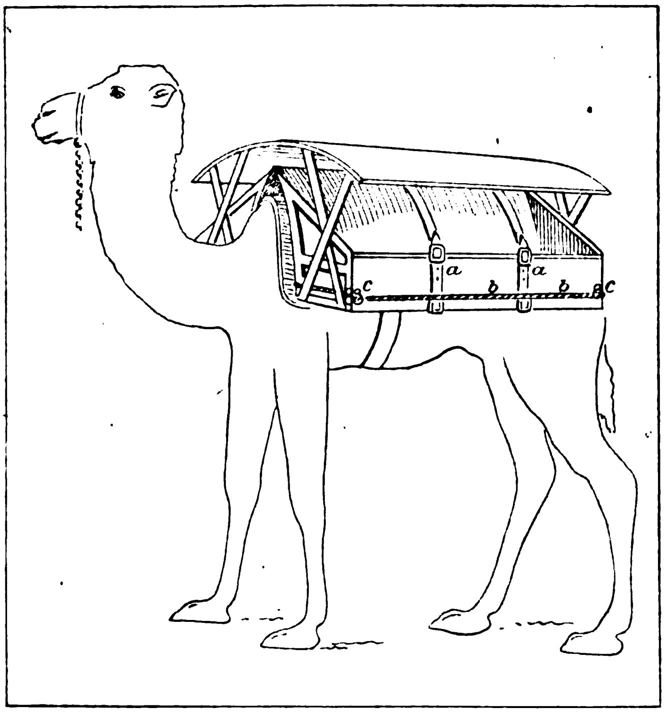
The remarkable ease and security with which they are able to travel over dry, hot, stony country owing to the peculiar construction of their padded feet renders them very well adapted for use on the north-west frontier of India. They are able to carry with ease 400 pounds and if well fed and looked after can carry without harm 600 pounds. The baggage camels in this expedition all carried an official load of 480 pounds with no marked ill effects. Camels are very willing workers and fairly easily trained to different loads. Some are, however, very bad tempered and will not hesitate to bite if annoyed. A camel bite makes a very nasty, large wound, usually intensely septic and one bite may easily kill a man. There are two main classes of dromedary, the one used as a baggage animal and the other for riding. The former was used for transporting patients. The baggage camel travels at a pace of 2 to 2½ miles per hour, the riding camel from 6 to 7 miles per hour.

The chief objection to the use of these animals for sick and wounded is their peculiar mode of progression. The camel in walking, at each step, puts both feet on the one side forward almost at the same instant and the repetition of this action first on one side and then on the other produces an up-and-down movement of the two sides of the animal and is apt to cause considerable fatigue to a rider if not accustomed to it. The movement is much less felt when riding in a conveyance strapped to the side than when sitting on the camel's back. The awkwardness of gait and rocking movement does not exist to an equal extent in all camels. For the Derajat Column a special camel corps was reserved for the sole purpose of carrying the sick and wounded and was found most satisfactory as unsuitable camels and those known to be bad-tempered were eliminated and only those accustomed to carrying kajawahs were employed. And now to turn to the conveyance in which the patient is placed on the camel's back. In India these structures are called kajawahs and there are many patterns of them. A kajawah is a form of litter which can be strapped to the side of a camel and is capable of holding a human being. They are by no means a modern contrivance having been used in the winter of 1798-1799 by General Bonaparte in his campaign in Syria.[1] The type then used was devised by

[1] A complete description of these with drawings will be found in Baron Larrey's memoirs : "Memoires de Chir. Mil. et campagnes de D. J. Larrey," Paris, tome 1, 1812.

Napoleon's Surgeon in Chief, Baron Larrey, and in appearance was not unlike the ordinary camel trunk but was made in such a way that sick or wounded could be easily placed in it and securely carried. When required for a lying-down patient one end of the litter was let down and supported, drawbridge fashion, at the requisite angle by two iron racks, one on each side, so as to afford the necessary length.

Figure IV



BRETT'S CAMEL KAJAWAH DEVISED IN 1839.

a......STRAPS WHICH PASSED OVER SADDLE.

b......STOUT ROPE WHICH PASSED THROUGH RINGS *C* AND OVER SADDLE.

In the year 1839 Surgeon-Major Brett of the Bengal Medical Services, Surgeon to the Governor-General's bodyguard, devised and constructed some kajawahs which he called "camel-dhoolies." Major Brett stated[1] that they proved most satisfactory conveyances and that "the experiments succeeded in every way as the most comfortable and safe mode of invalid travelling I have heard or read of." The description of the kajawah contained in this book appears to embody many of the essentials embodied

[1] Notes to a practical essay on "Some of the Principal Surgical Diseases of India," Calcutta, 1840, p. 505.

in the very latest pattern kajawah. For this reason Brett's kajawah is worthy of a brief description. Each litter was made of a very light wooden framework, adapted by its shape to the flanks of the animal and strengthened by iron bands in the direction of the chief strains. The framework at the bottom and sides was filled up with canework and strong tent cloth varnished. A light framework covered with dusootie cloth formed a shade over the litter, from the sides of which depended curtains. The litters were buckled on precisely in the same way as camel trunks by means of thick straps made of buffalo hide and still further secured by a strong rope passed through iron rings and crossed over the saddle. The latter prevented tilting outwards of the litter when loaded.

The litter was sufficiently long to accommodate a person lying at full length.

The camel as a means for transporting sick and wounded evidently fell into almost complete disuse chiefly because the kajawahs supplied were not sufficiently comfortable, most of the patterns being only capable of accomodating a patient in the sitting position.

Surgeon-Major G. J. H. Evatt, M.D., Medical Staff, in his "Personal Recollections[1] of the Afghan Campaigns of 1878-79-1880," remarks: "The transport was very defective. The need of a good kajawah for use with camels, a most important aid in war, was felt and the want still exists. If such an equipment could be found it would carry a sick man and his kit, and be of the greatest use for evacuation of milder cases."

No mention is made of camel kajawahs[2] in connexion with the sick and wounded transport employed by Lord Roberts in his march from Kabul to Kandahar in August, 1880, which consisted of the following:—

Dhoolies	11	For a Column of 10,148 troops, 8,143 native followers, and 11,224 animals.
Dandies	321	
Dhoolie Bearers	2,192	
Ponies for riding	286	
Donkeys	43	

In the Report on the Commissariat and Transport Arrangements of the Malakand Field Force 1897-98 bearers, dandies, ambulance ponies and stretchers are referred to as having been used, but there is no mention of the use of camel kajawahs.

In the operations against the Mahsud Wazirs in 1894-95, camel kajawahs were employed to a small extent[3] but they were evidently not a very successful pattern as may be judged from the following:—

"The camel kajawahs supplied to regiments were found most useful for

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[1] Reprinted from *Journ. of the United Services Institution of India*, 1890, in Journ. of the Royal Army Medical Corps, vol. v, 1905, p. 425.

[2] A.M.D. Report for 1880, Appendix III. Special Report on the Hospital Organization, Sanitation, and Medical History of the Wars in Afghanistan, 1878-79-1880, by Surgeon-General T. Crawford, M.D. Principal Medical Officer, His Majesty's Forces in Bengal.

[3] Operations against the Mahsud-Wazirs in 1894-1895. Appendix XVII, Section 42.

sick, both on the line of march and with sick conveys. It is recommended than ten pairs of an *improved* pattern of kajawahs be added to the equipment of each Field Hospital, and that quiet camels be selected to carry them."

During the first fifteen years of the twentieth century, kajawahs were not generally used on the north-west frontier of India, but the Piffer Regiments (frontier force regiments) had a small supply of them. The type was most uncomfortable being only capable of taking a patient sitting and even then his perch was precarious and dangerous.[1]

In an article[2] entitled "Ambulance Work in Hill Warfare from Front to Base," by Captain G. B. Carter, R.A.M.C., written in India in 1905, there is no mention whatever of kajawahs.

It, therefore, seems clear from the extracts quoted from "Military History" that although nearly all the medical authorities who commented on this form of transport seem to have realized the usefulness of the camel in mountain warfare, provided a safe, serviceable and comfortable kajawah was devised, they were not taken into general use. Dr. Brett's kajawah appears never to have been used on the Indian frontier.

A possible cause of this was the impractibility in early Victorian times of transporting equipment of this fragile and cumbersome type, more especially before the advent of good railways. Even at the present day kajawahs are very apt to arrive at their destination broken, as many who have served in any theatre of war where they were employed know only too well.

It was, therefore, really only during the operations on the north-western frontier of India in the closing years of the Great War of 1914-18 that free use was made of the wonderful advantages of the camel kajawah for carrying sick and wounded so far as India was concerned. This form of transport was, however, used in several of the other theatres of war, including Egypt, Mesopotamia and East Africa with the result that when medical arrangements were being made for the Waziristan Campaign of 1919-20 steps were taken to provide large numbers of kajawahs. When the operations commenced two types were issued—the Jolly pattern and the Turkish pattern. The Jolly pattern was a heavy, cumbersome affair by no means fool proof, which was supposed to fit on to the ordinary camel saddle or palan as it is called. It was found most unsuccessful and was discarded almost at once, in fact after the conclusion of the advance up the Tochi valley in December, 1919. The type is now obsolete and, therefore, need not be described in detail.

The Turkish pattern was exclusively used for the Derajat Column (see drawing).

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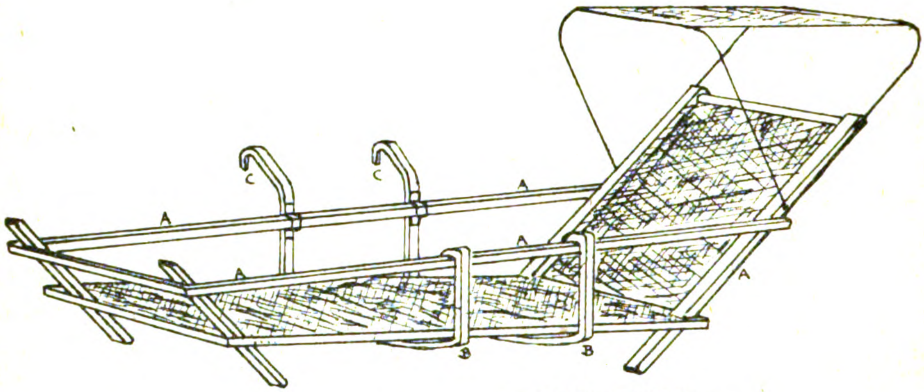
[1] This information was supplied by Colonel H. J. K. Bamfield, D.S.O I.M.S., who was for many years regimental medical officer to one of the frontier force regiments.

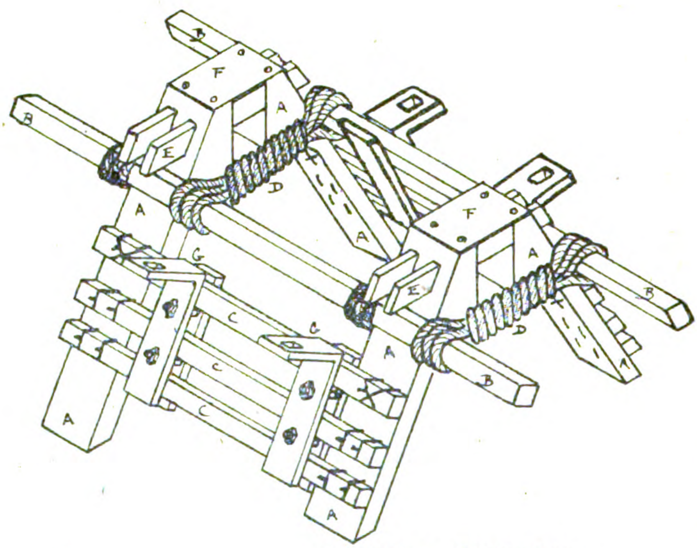
[2] JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, vol. v, 1905.

This type consists of two main parts, the bed-frame and the saddle. The *bed-frame* is made of a wooden frame (A); strengthened by two steel supports (B), each of which is riveted to the top bar on each side and finished off on the inside in the form of a hook (C), which fits into the eye of a bracket



— BED-FRAME —

FIG. V.



- CAMEL - SADDLE -

FIG. VI.

affixed to the saddle. The frame is lined with canvas, strengthened by strips of newar. At the head of the frame there are two steel supports for the hood, connected by two narrow strips of newar. Four newar straps with leather point and buckle pieces are attached to the bottom of the frame for securing the patient.

The *saddle* consisted of two wooden arches (A), fitting over the camel's back connected by two side poles at the top (B), and three side rails at each side (C). The poles at the top are braced together by four lashings to give rigidity to the saddle (D). The side rails are wired to the arches. Each arch is in two parts, connected by two wood pins (E) and a steel plate (F) secured to the top by four wood screws. Each saddle is provided with three pads stuffed with "Panni" grass or straw, a large pad for the front arch and two small ones for the rear arch. These pads are fastened to the arches by securing cords—eight on the large pad and four on each of the small pads. The pads are made of sail canvas covered with "tat-pattee" where they come in contact with the camel.

Attached to the top rail of the saddle on both sides are two brackets provided with an eye to take the hanging hooks of the bed frame (C).

A waterproof canvas hood is provided to enclose the bed frame. One side of the hood is fitted with a canvas flap which can be raised and secured by a strap. The opposite side has two holes cut in the canvas through which the hanging hooks of the bed frame pass.

PART II.

In order to explain the complete procedure for the evacuation of sick and wounded in mountain warfare it is proposed here to trace a patient from the time he was wounded to the time he reached a general hospital. For the sake of an example we will assume that the man was hit by a bullet in the leg causing an incomplete fracture of the tibia and that this happened just as he was approaching the summit of a peak on which a picket had to be established. The regimental stretcher bearers located from 400-500 yards away, generally half-way down from the summit of the hill, were sent up usually accompanied by the sub-assistant surgeon in sub-charge, if he was not otherwise engaged. The latter, or, if he was not present, one of the stretcher bearers rendered first aid and put the leg up in temporary splints. Then, placed on a stretcher, the patient began a very trying and difficult journey and descent down the mountain side over extremely steep and rough ground.

Six regimental stretcher bearers were invariably required to carry the wounded man down to the *regimental aid post* situated from 400 to 1,000 yards distant either in the valley below or at some convenient spot some way up the hill and close to regimental headquarters.

This journey might take anything from twenty minutes to an hour according to the nature of the ground and the distance to be traversed. The regimental aid post was invariably in the open, but when possible was placed under the cover of the side of a nullah. The medical personnel of the regimental aid post was composed of the regimental medical officer, the sub-assistant surgeon, when not out attending to a case, one N.C.O. and two to three stretcher squads of the bearer sub-division of the field

ambulance. The medical equipment used was much the same as that used at regimental aid posts in France and varied in amount according to the wishes of the particular medical officer but was always made up from articles contained in the two field medical panniers, the medical companion, surgical haversack, together with an assortment of splints.

When the casualties were heavy, the field ambulance bearers assisted the regimental stretcher bearers to clear the wounded, additional bearers being pushed up as required.

After the patient had been attended to by the regimental medical officer and a tally with particulars of the wound affixed, the wounded man was then carried along the river bed by bearers from the field ambulance to the *advanced dressing station* situated in reasonable safety some 1,000 yards behind the aid post. During these operations practically the whole of the bearer personnel of one of the two field ambulances was detailed to attend to the forward evacuation of the wounded. Usually two advanced dressing stations were formed—one on the right bank of the river and the other on the left bank, and each advanced dressing station respectively received cases from the area nearest to it. The officer commanding the evacuating field ambulance usually took up his position on some commanding spot in the vicinity of the brigade headquarters of the attacking troops where he could not only see how the attack was progressing, but also obtain immediate information from the brigade of any change in the disposition of the troops, and so be in a position to issue orders to the advanced dressing station should the situation require the advance or retirement of that formation. Advanced dressing stations were always withdrawn to the main camp on the termination of an action.

An advanced dressing station was marked by a large Geneva Cross flag. This was important not as a measure of protection against the fire of an enemy disregarding the rules of the Geneva Convention, but the flag served as a guide for the field ambulance bearers, who on their first journey from the regimental aid post would probably not otherwise know the exact location of the dressing station. The personnel of an advanced dressing station was formed by a medical officer, a sub-assistant surgeon, one or two ward orderlies, a British nursing orderly, and other ranks as required, which always included cooks.

The equipment of the advanced dressing station consisted of:—

(1) A mule load of blankets.
(2) Cooking utensils for the supply of hot drinks and tea.
(3) A supply of tea, sugar, milk, brandy, biscuits, and water.
(4) Surgical haversacks.
(5) Hot-water bottles.
(6) Reserve dressings—Panniers No. 1 and No. 2.

On occasions a field hospital tent was erected but more often the dressing station was in the open on a shaded spot of ground on the lee side of a nullah. After the wounded man had received all the attention

possible under such circumstances he continued his journey down the valley on the stretcher now carried by bearers of the *bearer unit*, to the main dressing station. Some of the slightly wounded were conveyed over this part of the journey by ambulance ponies. Camel kajawahs were also used for slight cases. The distance from the advanced dressing station to the main dressing station varied from half to two miles. The main dressing station was generally located where the headquarters of the column had been established.

As was previously stated the *main dressing station* was formed by a complete field ambulance. Here the wounded man stopped for at least one night, whether classed as a slight or a serious case, as all convoys of whatever description moved off towards the base only once a day, and started from camp at daybreak or thereabouts. At the main dressing station it was possible to make the patient comparatively happy and comfortable. All serious cases were provided with stretchers to sleep on and an ample supply of blankets was available to combat the cold during the winter months.

All wounds were thoroughly dressed and attended to, fractures put up firmly and cases operated on if considered advisable. When considering the question of operating several factors had to be carefully thought out. Firstly, the number of days the column expected to be located at the site was important, as it is well-known that patients stand a rough journey very badly if moved within twenty-four hours after an operation however slight. Secondly, if there was any likely risk of a retirement no serious surgical procedures except for the immediate saving of a man's life was undertaken. The reason for this is obvious.

Anti-tetanic serum was administered to all wounded at the main dressing station; the latter was extremely important as cases of tetanus had been known to occur in the area of the operation. Anti-tetanic serum could not be given at the advanced dressing station with safety as the conditions under which medical officers had to work were quite unsuitable from the point of view of asepsis.

If fit to travel the morning after arrival at the main dressing station the wounded casualty started on another very trying journey to the next permanent camp, or post as it was called, down the line. There were three ways he could be carried on this journey. Firstly, in a kajawah, secondly on an ambulance pony, and thirdly, on a man handled stretcher. These methods of transportation have already been referred to; we now come to the detail of handling them. By whatever method the patient was carried, the bearers necessary to look after him or carry him were supplied from the bearer unit located at the column headquarters. The down sick convoy was met half way by medical personnel from the next post, and the personnel from the main dressing station was relieved and returned to column headquarters.

The structure of the kajawah having already been described it remains to describe how it is used. Of the three forms of transport used during these

operations in the forward roadless area the camel kajawah was the easiest from a purely transport point of view although not as comfortable by any means as conveyance on a stretcher carried by hand. For this reason serious cases were never carried in kajawahs.

In order to load the kajawahs it was first necessary to persuade the camel to go down on to his knees by making a peculiar hissing noise, at the same time pulling *very gently* on the string attached to his nose. This procedure was usually performed by the "sawarn" or camel attendant whom the camel knew and was therefore more likely to obey his words, or rather hisses, of command. Before proceeding any further it was well to ensure that the sawarn remained at the camel's head to prevent the animal from jumping up in the middle of the loading operation and to restrain it from swinging round its long neck and biting one of the unfortunate bearers employed in loading up the patients. Next the two patients had to be lifted and simultaneously placed in the kajawahs in order to maintain an equipoise in each kajawah strapped on either side of the camel's back. Then the patients' kits were placed in the kajawahs together with their rifles and about twenty rounds of ammunition, so that if necessity arose they could at least help to defend themselves. At this stage it was important to note whether the two kajawahs were correctly balanced, if not this was rectified by readjusting the mens' kits, and if this was not effective by placing large stones in the lighter kajawah. The latter procedure was rarely necessary if the loading officer was careful to chose patients of more or less the same stature and weight. The camel was made to stand up by the sawarn. This was accompanied even in the case of a docile and steady animal by a violent jerk, and sometimes the movement was so violent and irregular that the unfortunate patient was almost precipitated completely out of the kajawah. At Khirgi, Jandola and Kotkai kajawah loading and unloading platforms were constructed consisting of two wooden platforms 4½ feet wide, 8 feet 6 inches long and 4 feet 3 inches in height, with sufficient room for the camel to stand between them with the bed-frames resting on the platforms. Steps led from the ground to the platform (see figs. vii and viii). These contrivances were found beneficial as they avoided the necessity of making the camel kneel down before being loaded or unloaded. The wounded men first loaded on the camels had to wait some little time before the remaining patients were loaded. During this interval the loaded camels often became more and more restive and if not continually looked after by the sawarns the kajawahs of different camels were liable to cannon into one another or become entangled and so jolt the wounded man or perhaps break the kajawah. For this reason it was found advisable to have one Army Bearer Corps bearer told off to each camel to look after the interests of the patients for, as a rule, there was only one sawarn for three to five camels, and very often it was extremely difficult to keep this one man awake at that time of the morning, usually daybreak, when the convoy was loaded.

Stretcher Bearers.—This method was employed for severe cases the ordinary stretcher being utilized and invariably carried shoulder high. The contra-indications from time to time quoted against carrying patients in this manner were not found of sufficient importance to preclude its

FIG. VII.

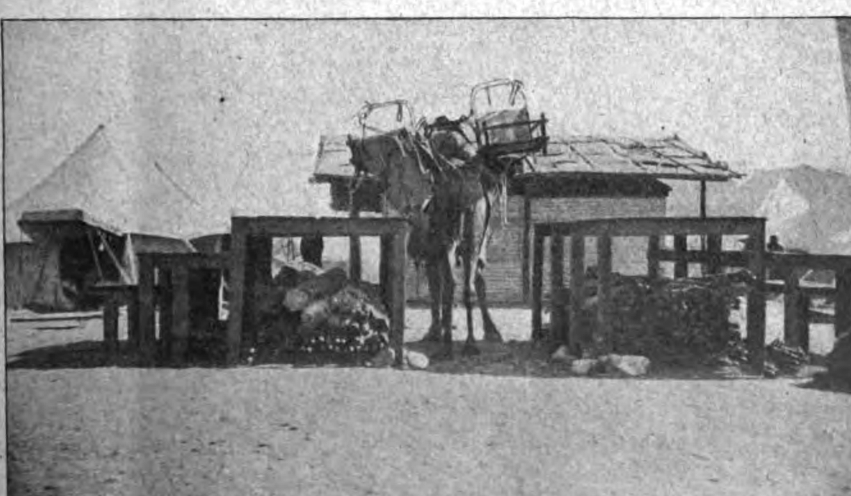


FIG. VIII.—Camel in position ready to be loaded.

adoption. The chief objections against carrying stretchers shoulder high are stated to be inability to obtain four men of equal height; the height of the patient off the ground making him feel unsafe and giddy, and lastly liability to fall off the stretcher. Great care had to be exercised by

the bearers carrying the patients along the winding river bed, necessitating continually crossing and recrossing the river which in places was knee deep or more and the bed of which was not only composed of boulders but otherwise uneven, causing sudden variations in the depth of the water. For

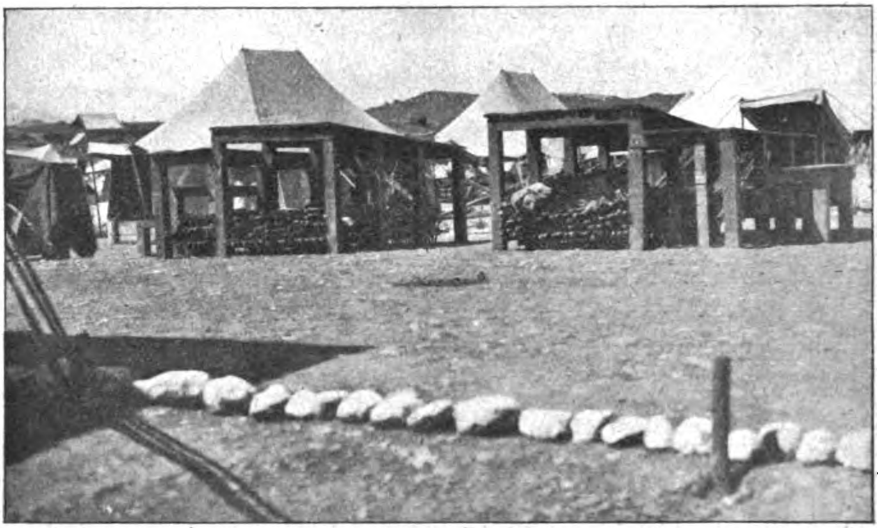


FIG. IX.—Unloading platform, Jandola.

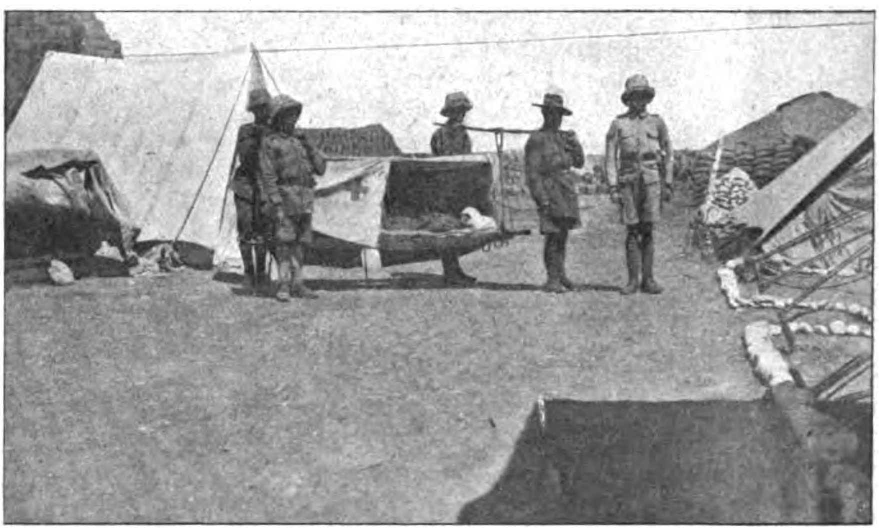


FIG. X.—The ordinary stretcher with dhoolie attachment at present in use on the north-west frontier of India. The tent on the left is a 160 pounds hospital tent.

these reasons eight men had always to be allotted to each stretcher party as otherwise the bearers became too fatigued to carry their patient properly.

When the *sick convoy* composed of roughly 90 per cent camels, 7 per cent stretchers, and 3 per cent ponies, was ready it moved off about an hour after dawn some distance behind the company or companies of infantry on "convoy duty" for the day. The distance to be covered was from eight to twelve miles, and the time taken from three to six hours. The journey was a tedious one owing to the slow moving pace of the camels and occasional halts necessary, whilst the protective troops took up their pickets or on occasions when the convoy was held up for any time up to an hour as a result of enemy sniping from one of the hundreds of nullahs on either side of the river. On the completion of the journey the wounded man was received into a *Combined Staging Section.* The composition of this unit has already been described, but a short account of its working is necessary. The officer commanding the combined staging section was *ipso facto* also senior medical officer, and responsible for all medical arrangements of the permanent post where the unit was located. Each post was garrisoned by at least one infantry battalion, but more often two, or even three battalions. The officer commanding post was the senior battalion commander. One very important difference between military operations undertaken on the north-west frontier of India and those in a civilized country is that the lines of communication are almost invariably in enemy country and, therefore, liable to attack. The attacks during these particular operations were very frequent but as a rule were repelled without serious loss. On one occasion however, a gang of roughly 200 Mahsuds and Wana Wazirs attacked one of the posts from two sides simultaneously at about eleven p.m. on a pitch black night. The camp was taken by surprise, the pickets on the perimeter were overwhelmed, with the result that within ten minutes the camp was swarming with the enemy who proceeded to rifle all the stores. They remained in complete command of the post for about one and a half hours, and took away with them quantities of goods consisting largely of blankets, articles of clothing, food, ponies and mules. Our casualties amounted to roughly eighty killed and wounded, including one British officer killed and three British officers wounded out of a total of six British officers in the camp.

The senior medical officer was always warned by wire the previous night of the number of cases to expect; the message ran something as follows: "For evacuation Sixth A.A.A., B.O. stretcher one, A.A.A., I.O.R. stretcher four, A.A.A. kajawah 36."

On arrival at a combined staging section the patient was put to bed on a palliasse in a field hospital tent. Large numbers of stretchers were available, and therefore a considerable number of patients were given one to lie on in addition to the palliasse. As has been previously stated the accommodation was 100 beds, and was found sufficient except on a few exceptional occasions after heavy fighting. When this occurred one or two Sections of the Indian field ambulance allotted to the lines of communication were sent, if not already in the post, to relieve the congestion.

The A.D.M.S. lines of communication was kept informed by wire of the number of cases likely to be evacuated from the column and therefore had time to alter the disposition of the Indian field ambulance as circumstances required.

With the extra sixty Army Bearer Corps men provided the combined staging sections were able to cope with the work. The personnel required for the convoys was found a big drain at times; five stretcher cases took forty men straight away, and when possible one Army Bearer Corps man was allotted to every two camels. It was found a considerable economy in personnel to pitch two field hospital tents together end to each other; as only two ward orderlies for Indian patients were allowed, these had to be supplemented by another twenty Army Bearer Corps men, twelve on day duty and eight on night duty. In many instances it was found that the Army Bearer Corps men made better ward orderlies than the two regimental Sepoys provided, who often took little interest in their work.

The patient remained at the combined staging section at least one night and then was moved on down the line to the next post as before described, and so his journey continued on down the Tank Zam valley until he reached the road head at Khirgi, with this difference, that at Jandola (see diagram and map) he passed through a casualty clearing station where he might remain some days. It is not proposed to deal with the working of a casualty clearing station. At Khirgi motor ambulance cars were available, and by this form of transport he was conveyed to the Indian general hospital at Manzai. From here, if for evacuation out of the force, he was transferred by motor ambulance car to Railhead at Kaur Bridge, where he was transferred to an ambulance train (narrow gauge). If not for evacuation out of the force he was transferred to one or other of the Indian general hospitals at Tank or Dera Ismail Khan. From Khirgi onwards his progress, apart from climatic unpleasantness was more or less on the same lines as in France.

Conclusion.

It is worth while to consider a few points in connexion with the lessons learnt regarding the care of the sick and wounded in mountain warfare.

(1) *Personnel.*

(*a*) The advantage of having an experienced surgeon with the field ambulance accompanying the striking column proved of great value. Not only can many lives be saved by early operation but also the wounded man's subsequent stay in hospital can be much reduced, so rendering him fit to return to duty in much less time, with the consequent saving in man power. The tactical contra-indications for operation have been referred to.

(*b*) The importance of having a considerable number of stretcher-bearers available for immediate mobilization should the anticipated military operations be likely to be accompanied by heavy casualties.

(c) This was the first Indian Frontier Campaign in which a bearer unit was used. Its use undoubtedly proved a great success in providing for the evacuation of cases from the advanced dressing station to the main dressing station and from the main dressing station to the combined staging section. This made it possible to utilize a complete field ambulance for the evacuation of cases from the regimental aid posts to the two advanced dressing stations and also made it possible for the field ambulance personnel to assist the regimental stretcher bearers in clearing the field in front of the regimental aid post when the fighting was exceptionally heavy.

(2) *Transportation of the Sick and Wounded.*

(*a*) With regard to transport the camel kajawah was by far the most convenient method from an economical point of view in personnel. Four cases could be evacuated by camel with one man to look after them whereas by man-handled stretchers four cases required thirty-two men. The ideal would be to have a camel kajawah corps kept up both in peace and war for the sole purpose of evacuating sick and wounded. This would ensure the right type of camels being available at the outbreak of any frontier war. The medical and other personnel would understand this form of transport and it would stimulate constant inquiry into the best form of kajawah. In many previous frontier campaigns the medical authorities have urged that camel kajawah transport is most effective if a good kajawah is provided but for some reason or other their advice was not accepted. Ponies for the reasons stated previously proved unsatisfactory. There were many defects in the Turkish kajawah already described amongst which were:—

(i) The saddles were badly put together. The method of wiring the side rails to the two arches was unsatisfactory as the rails very soon became loose. The brackets supporting the bed frame were fastened to the side rail by two bolts and nuts. The latter worked loose very quickly.

(ii) The bed frame was altogether too flimsy. The wooden framework was not made of strong enough wood.

(iii) The saddle packs were not very satisfactory. They were not firm enough and were apt to gall the camel's back owing to rubbing or getting out of position.

(iv) The hooks finishing off the two supports of the bed frame which fitted into the brackets attached to the saddle were not made of sufficiently hardened steel so that with the weight of the patient they soon became bent resulting in the bed frame tilting downwards, making the patient's position extremely uncomfortable and dangerous.

(*b*) *New type of kajawah.*—Since these operations took place a new type of kajawah has been devised remedying all these defects. It is known as the "S and T pattern."

(*c*) *Repairs and upkeep of kajawahs.*—It is suggested that a joiner should be allotted to each permanent camp on the lines of communication

for the sole purpose of looking after the kajawahs; he would be supplied with the necessary spare parts, screws, nuts and bolts required to mend damaged parts before they got beyond repair. Each unit should have its name and number stencilled on its kajawahs so that an inspecting officer could come down on any particular unit whose kajawahs were in bad repair.

(3) *Feeding of Patients.*

Certain extras in the diet line are important. A good stock of tinned milk, sugar, tea and biscuits, should be kept in each field ambulance or staging section. A bowl of hot tea with a large proportion of milk and a few biscuits was found most welcome and reviving to patients, especially Indians, in the early morning before being evacuated by convoy. Tea is easily prepared and does not take long for patients to consume and therefore does not delay the convoy.

(4) *Extra Clothing.*

It was found a good plan to stock a moderate supply of extra clothing for Indian patients. Special sanction for this concession was obtained from the G.O.C. Quite a number of patients had to be given a complete change of clothes owing perhaps to hæmorrhage or other causes.

(5) *Blankets.*

An extra supply of blankets was also sanctioned for these operations. Staging sections were given 100 extra each for use in hospital wards and fifty extra for use with the kajawahs. This was considered necessary on account of the extreme cold in winter. All patients were given three blankets whilst in hospital. I might remark here that many of the Indian Sepoys had never experienced real cold in their lives before and therefore felt the low temperature very much.

(6) *Operating Tents.*

During the earlier phases of the fighting no operating tents were carried as they were not then included in the mobilization equipment for field ambulances and staging sections. This was found most inconvenient; many ingenious devices for pitching the field hospital tent or a combination of single fly 160 pounds tents I.P. were used by various officers commanding, but apart from the fact that this meant depleting the unit of available hospital accommodation they were not found satisfactory. Later the forward medical units were supplied with special operating tents made at Cawnpore for the purpose. These tents were found of great service and were, considering their size, very light and capable of being carried on two camels with ease. The rearward units were supplied with E.P. hospital tents for this purpose, which, except for their weight, were found to meet all wants.

In conclusion I cannot do better than quote the words of the official dispatch:—

"The Headquarters of the Derajat Column were dispersed on May 7

and their dispersal brought the operations to an end. Thus ended a frontier campaign of unparalleled hard fighting and severity. The enemy fought with a determination and courage which has rarely, if ever, been encountered by our troops in similar operations. The character of the terrain, combined with trying and arduous climatic conditions, alone presented difficulties before which the most seasoned troops might well have hesitated. The resistance of the enemy was broken and the difficulties successfully overcome by a force composed almost entirely of young Indian troops. No British troops, except for the Royal Air Force, and a British Battery of Mountain Artillery, were employed. This fact has without doubt, considerably raised the prestige of the Indian Army on the frontier and increased the esprit de corps of the troops engaged."

APPENDIX I.

	Indian Field • Ambulance, 1919	Combined Field Ambulance, 1919	Field Ambulance (Provisional W.E.), 1921
Officers	5	5	5
Assistant surgeons	Nil	2	4
Sub-assistant surgeons	8	6	4
Packstore serjeants	4 (A)	4 (B)	4 (B)
British nursing orderlies	Nil	2	4
Ward servants (Indian)	Nil	5	8
Bearers	133 (C)	133 (C)	150
Cooks, water carriers, sweepers, dhobies	24	24	32

(A) Packstore havildars.

(B) Packstore serjeant and 3 packstore havildars.

(C) To each of these units 72 bearers were provided surplus to war establishment

	Combined Staging Section (B)	Casualty Clearing Station (Provisional W.E. 1921)
Officers	2	5
Assistant surgeons	2	4
Sub-assistant surgeons	2	4
Packstore serjeants	1	2
Packstore havildars	1	Nil
British nursing orderlies	2	4
Nursing orderlies (Indian)	2	8
Ward servants (Indian)	5	6
Bearers	52 (A)	100
Cooks, water carriers, sweepers, dhobies..	19	27

(A) 60 extra bearers were provided to each Combined Station Section shortly after operations of Derajat Column commenced.

(B) Made up of one Indian Staging Section plus one British Staging Section.

BEARER UNIT.

Officers	2	
Assistant surgeons	4	
Clerks	1	
Havildars (stores)	1	
Havildars Major (bearer)	1	
Havildars (bearers)	8	
Naicks	8	
Bearers	468	* 8 men trained in
Cooks, sweepers, etc.	25	semaphore signalling

FURTHER OBSERVATIONS ON THE COMPLEMENT FIXATION TEST IN GONORRHŒA WITH A VIEW TO SIMPLIFICATION OF TECHNIQUE AND ENHANCEMENT OF RELIABILITY.

A REPORT TO THE MEDICAL RESEARCH COUNCIL.

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IN a previous report submitted to the Medical Research Council a method was described for conducting the "Complement Fixation Test" in gonorrhœa, but although that method gave fairly satisfactory results in the examination of cases of the disease it was open to serious criticism on the following grounds :—

(*a*) That for each test made, using four tubes for the test itself and four tubes for controls, the method was much too laborious to be generally applicable.

(*b*) That the quantity of complement deviated in the test—1·5 m.h.d.—left a dangerously small margin for the occurrence of non-specific absorption or for destruction of complement while the test proceeded.

(*c*) That the antigen used—prepared by alternate freezing with liquid air and thawing—was costly and in many laboratories its preparation presented extreme difficulty.

(*d*) That absorption of the sera to be tested with the cells of the hæmolytic couple prior to making the test added greatly to the labour of the technique without perhaps giving an increase in delicacy of the reaction commensurate with that labour.

This communication deals with a further series of observations designed to meet criticism falling under these four headings and to amplify and corroborate those findings previously reported.

I.—CAN THE TEST BE LIMITED TO TWO TUBES WITH CORRESPONDING CONTROLS CONTAINING 0·025 AND 0·05 OF THE SERUM TO BE TESTED WITHOUT SERIOUSLY INTERFERING WITH ITS DELICACY?

Discussing this question in the previous report it was shown that in the series therein dealt with a discrepancy of only three per cent was introduced on thus limiting the test to two tubes for the reaction and two for the corresponding serum controls.

A further series of 300 comparative tests of this kind has since been conducted and the results bear out the previous finding. The discrepancy introduced by limitation of the test in the manner described is about four per cent.

II.—Can the Quantity of Complement to be deviated in the Test be increased to 2 m.h.d. without seriously interfering with the delicacy of the reaction?

This question is one of great importance, for upon it really depends the application of the test to clinical work.

In a previous communication stress was laid upon the danger of using the technique therein described in which only 1·5 m.h.d. of complement was deviated in the test and attention was called to the importance of attempting to carry out the reaction using at least 2 m.h.d. of that reagent.

In the series at present under discussion there are 189 tests conducted with sera from the same number of cases in which full information concerning the microscopical examination of discharges and clinical examination of the patient is available. The results obtained in examining them are compared in Table I with those obtained in the ninety-six dealt with in the previous paper. These 189 tests were made with a technique involving the deviation of 2 m.h.d. of complement while the technique used in examining the previous series of ninety-six was such that only 1·5 m.h.d. was deviated.

TABLE I.

	Series in which 1·5 m.h.d. was used			Series in which 2 m.h.d. was used		
	Fixation test	Microscopic examination	Number	Fixation test	Microscopic examination	Number
1	−	−	37	−	−	88
2	+	+	37	+	+	72
3	−	+	16	−	+	24
4	+	−	6	+	−	5

A comparison of 3 with 2 of each series gives one some indication of the delicacy of the test, for the former represents its failure and the latter its success in revealing the presence of antibodies in known cases of infection. The ratio in the first series is 16 : 37 or 43 per cent, while in the second it is 24 : 72 or 33 per cent.

It is to be noted that the figures for each series deal with comparable material in so far as they were drawn from similar populations, and while the numbers are too small to *prove* that the increased quantity of complement does not lessen the delicacy of the test, nevertheless the findings do not suggest that this modification has any serious influence in that direction.

What is more significant is the comparison of 2 and 4, for regarded from a purely critical viewpoint 4 may be considered as the example of a false positive reaction. The ratio of possible false positive to true positive in the first series is then 6 : 37 or 16 per cent, while in the second it is 5 : 72 or 7 per cent. This indicates that although there may be *some*

loss of delicacy resulting from the use of the larger dose of complement this is more than compensated for by the added value of a positive finding when a larger dose is used.

It is of some interest more fully to consider those cases in which the results obtained by complement fixation disagree with those obtained by microscopical examination, for it is upon these that it may be concluded that nothing is lost and something may be gained by increasing the dose of complement to two m.h.d.

Dealing in the first place with those in which the fixation reaction is positive and the microscopical examination negative :—

(*a*) In the first series where 1·5 m.h.d. of complement was used ninety-six tests were made and six of these exhibit this discrepancy. One had had gonorrhœa one year previously although the discharge now appears to contain no gonococci. Two, although negative microscopically, have vaginal discharge and the husband of each is, or recently has been, under treatment for gonorrhœa. Three, although negative microscopically, are regarded on clinical grounds by the Venereal Diseases Officer as cases of gonorrhœa.

The last three cases are really crucial, for apart from clinical opinion there is really no evidence that these are cases of gonorrhœa, and regarded critically they may be considered examples of false positive reactions—3 : 96.

(*b*) In the second series where two m.h.d. of complement was used 189 tests were made and five of these exhibit this discrepancy. One, although negative microscopically, has vaginal discharge and her husband is, or has been recently, under treatment for gonorrhœa. Two exhibited focal reaction on administering a provocative dose of gonococcus vaccine. One has had vaginal discharge for eight months although recent examinations fail to show gonococci. In one case no information is obtainable as to duration.

The last two cases, then, represent the presumptive error on the positive side—2 : 189.

Dealing secondly with the converse, where the fixation reaction is negative and the microscopical examination positive, there were 16 cases in the first series of 96 and 24 cases in the second series of 189 which exhibited this discrepancy. The notable features of these are compared in Table II.

TABLE II.

Number in series	96
Number of positives	37
Dose of complement	1·5 m.h.d.

Duration	Number showing discrepancy
Less than three weeks	8
Three to six weeks	1
Six weeks to three months	5
Four months to six months	1
? duration	1

Number in series	189
Number of positives	72
Dose of complement	2 m.h.d.

Duration	Number showing discrepancy
Less than three weeks	11
Three to six weeks	2
Six weeks to three months	3
Two years	1
Three years	2
Four years	1
? duration	4

If we allow that about three weeks must elapse for the development of demonstrable antibodies the ratio of failures to successes in the first series is 8 : 37 and in the second 13 : 189, so corroborating the conclusion already drawn from this aspect of the investigation.

III.—Are the Results obtained when a Simple Saline Suspension of the Gonococcus is used as Antigen as satisfactory as when the Antigen employed is prepared by the alternate Freezing and Thawing Process?

This question is quite as important as the previous, for the difficulty of preparing antigen by the process of alternate freezing and thawing with liquid air precludes its use in most laboratories, and if it can be shown that a simple saline suspension is as satisfactory as the other for the purpose in view the practical value of the test is greatly enhanced. Up to the time of writing 302 additional tests have been carried out in duplicate, using

(*a*) Antigen prepared by the alternate freezing and thawing process.

(*b*) Antigen consisting of very young cultures simply suspended in saline as described in Section III, subsection e, p. 23, of the previous report.

The tests were made in duplicate using each antigen in presence of 0·025 cubic centimetre and 0·05 cubic centimetre of the sera under investigation, while the quantity of complement to be deviated was 2 m.h.d.

Summarizing the results in these 302 tests it was found:

(*a*) That tests with both antigens were negative with both dilutions of the sera in 141 instances.

(*Note.*—This figure 141 includes a number of known negative sera from cases of other diseases where gonorrhœa could be excluded. These were tested in small batches along with the diagnostic reactions in order to determine whether the test is absolutely safe from the point of view that it will never give a really false positive reaction. The series is being continued and when an adequate statistic is available the results will be reported.)

(*b*) That tests with both antigens were positive with both dilutions of the sera in eighty-two instances.

(*c*) That in nineteen instances there was incomplete fixation with one or other antigen or with both antigens in presence of at least one dilution of the serum.

(*d*) In twenty-five instances the discrepancy was marked between the results obtained with one antigen and those obtained with the other.

(*e*) The serum was anticomplementary in thirty-five instances.

The actual results obtained in categories (*c*) and (*d*) are set forth fully in the following tables, III, IV, V, VI and VII.

Of the eleven tests set forth in Tables III and IV there are, therefore, eight in which the "simple antigen" gives more marked fixation than that obtained with the "frozen antigen," and in all of them the microscopical

examination was also positive, while in six of the eight the patient was under, or had recently been under, vaccine treatment when the test was made.

TABLE III.—Complete Fixation with the Higher Concentration of Serum in Presence of both Antigens but Incomplete with the Lower Concentration of Serum in Presence of one or both Antigens.

Reference No.	Frozen antigen		Simple antigen		No antigen		Sex	Result of microscopical examination	Vaccine or no vaccine	Remarks
	Quantity of serum		Quantity of serum		Quantity of serum					
	0·02	0·05	0·025	0·05	0·025	0·05				
5707	++++	++++	—	+++	—	—	F.	+	+	
6570	+	++++	+	++++	—	—	F.	—	—	Husband has gonorrhœa
330x	++	++++	++	++++	—	—	F.	0	—	
6515	—	++++	++	++++	—	—	M.	+	+	
4766	—	++++	++	++++	—	—	F.	+	—	
6687	+	++++	++++	++++	—	—	M.	+	+	

In this and the following tables the signs referring to complement fixation are :—

++++ = complete fixation, entire absence of lysis.
+++ = almost complete fixation, trace of lysis.
++ = marked fixation, lysis not marked.
\+ = only partial fixation, lysis about 50 per cent.

In the column marked "vaccine or no vaccine" :—

\+ means patient under vaccine treatment.
— means no vaccine treatment.

In the column marked "microscopical examination" :—

\+ means Gram-negative diplococci found.
— means Gram-negative diplococci not found.
0 means examination not made.

TABLE IV.—Complete Fixation with the Higher Concentration of Serum in Presence of the "Simple Antigen," but Incomplete therewith in Presence of the "Frozen Antigen."

Reference No.	Frozen antigen		Simple antigen		No antigen		Sex	Result of microscopical examination	Vaccine or no vaccine
	Quantity of serum		Quantity of serum		Quantity of serum				
	0·025	0·05	0·025	0·05	0·025	0·05			
6491	++	++	++	++++	—	—	F.	+	+
6729	+	+	++++	++++	—	—	F.	+	—
5576	—	++	++	++++	—	—	M.	+	+
5624	—	+	+	++++	—	—	M.	+	+
6254	—	—	++++	++++	—	—	M.	+	+

There are two instances in which the degree of fixation is the same with both antigens, and only one in which fixation with the "frozen antigen" is more adequate than that with the "simple antigen."

TABLE V.—Complete Fixation with the Higher Concentration of Serum in Presence of the "Frozen Antigen," but Incomplete in Presence of the "Simple Antigen."

Reference No.	Frozen antigen		Simple antigen		No antigen		Sex	Result of micro-scopical examina-tion	Vaccine or no vaccine
	Quantity of serum		Quantity of serum		Quantity of serum				
	0·025	0·05	0·025	0·05	0·025	0·05			
2149	++++	++++	++	++	–	–	M.	+	+
6397	++++	++++	++	++	–	–	M.	+	+
6317	++++	++++	++	++	–	–	F.	+	+
33x	++++	++++	++	++	–	–	F.	0	0
6334	+	++++	++	++	–	–	F.	+	+
235y	–	++++	++	++	–	–	F.	0	–
141y	–	++++	–	++	–	–	F.	+	–

Table V therefore shows seven instances in which fixation with the "frozen antigen" is somewhat more active than that with the "simple antigen." In five of these the result is concordant with the microscopical examination, while four of the patients were, or had recently been, under vaccine treatment when the test was made.

Of these eighteen tests dealt with in Tables III, IV and V, there are four—5624, 6729, and 6254 in Table IV, and also 141y in Table V—in which a false report would have been given had only one antigen been employed. Therefore there are fourteen additional positive results to be added to those already noted (p. 23 *b*) making a total of ninety-six positive reactions, while the discrepant results obtained with the two antigens and so far scrutinized number four.

TABLE VI.—Partial Fixation with Both Antigens.

Reference No.	Frozen antigen		Simple antigen		No antigen		Sex	Result of micro-scopical examina-tion	Vaccine or no vaccine
	Quantity of serum		Quantity of serum		Quantity of serum				
	0·025	0·05	0·025	0·05	0·025	0·05			
6626	++	++	++	++	–	–	F.	+	–
T	++	++	++	++	–	–	F.	0	–
6688	++	++	++	++	–	–	F.	+	–

Reactions of the type shown in the above table have been reported on as "probably positive but exhibiting such a feeble reaction that the result is to be accepted with reserve."

That one cannot really report such as positive is shown by the case "T," for the serum was that of a female suffering from tuberculosis in whom gonorrhœa, present or past, could be definitely excluded.

TABLE VII.—Tests in which there was only a Suspicion of Fixation with Both Antigens.

Reference No.	Frozen antigen		Simple antigen		No antigen		Sex	Result of microscopical examination	Vaccine or no vaccine
	Quantity of serum		Quantity of serum		Quantity of serum				
	0·025	0·05	0·025	0·05	0·025	0·05			
3934	–	+	–	+	–	–	M.	0	0
2699	–	+	–	+	–	–	M.	0	0

These two I should regard as negative, making the total of negative reactions with both antigens 143.

Reviewing the results in the light of the observations noted in Tables III, IV, V, VI and VII, it may be stated that:—

(*a*) Both antigens gave negative results in 143 instances.

(*b*) Both antigens gave positive results in ninety-six instances.

(*c*) Both antigens gave suspicious but not diagnostic fixation in three instances, and one of those, "T" of Table VI, must frankly be regarded as an error on the positive side.

(*d*) Antihæmolytic qualities prevented a report being given in thirty-five instances.

(*e*) There remain, therefore, 25 in which the discrepancy between the results obtained with the two antigens is decided, but 4 of these have already been dealt with in the comments on Tables IV and V, leaving 21 that have still to be considered.

TABLE VIII.—Discrepancies in which the "Simple Antigen" gave a Positive or Partial Fixation and the "Frozen Antigen" no Fixation.

Reference No	Frozen antigen		Simple antigen		No antigen		Sex	Result of microscopical examination	Vaccine or no vaccine	Remarks
	Quantity of serum		Quantity of serum		Quantity of serum					
	0·025	0·05	0·025	0·05	0·025	0·05				
5624	–	–	++++	++++	–	–	M.	+	+	3.4.23. See also Table IV
6595	–	–	++	++	–	–	F.	+	–	
92x	–	–	++	++	–	–	M.	+	?	
5759	–	–	++	++	–	–	F.	–	–	
6649	–	–	++	++	–	–	M.	+	–	9.5.23. Three weeks' duration
6649	–	–	++	++	–	–	M.	+	–	20.6.23
6389	–	–	++	++	–	–	M.	+	–	
6736	–	–	++	++	–	–	F.	+	–	
122x	–	–	++	++	–	–	M.	+	?	
402y	–	–	++	++	–	–	F.	0	–	
5281	–	–	++	++	–	–	M.	0	–	
425x	–	–	++	++	–	–	F.	0	–	

TABLE IX.—DISCREPANCIES IN WHICH THE "SIMPLE ANTIGEN" GAVE A NEGATIVE REACTION AND THE "FROZEN ANTIGEN" A POSITIVE OR PARTIAL REACTION.

Reference No.	Frozen antigen		Simple antigen		No antigen		Sex	Result of microscopical examination	Vaccine or no vaccine
	Quantity of serum		Quantity of serum		Quantity of serum				
	0·025	0·05	0·025	0·05	0·025	0·05			
Dx	++	++++	–	–	–	–	F.	0	–
4766	++	++	–	–	–	–	F.	+	–
83x	+	++	–	–	–	–	M.	+	0
6505	–	++	–	–	–	–	M.	+	+
334y	–	++++	–	–	–	–	F.	0	0
111x	–	++	–	–	–	–	M.	+	?
438y	–	++	–	–	–	–	F.	0	–
15x	–	++	–	–	–	–	M.	–	?
74x	–	++	–	–	–	–	M.	?	?

The type of reaction shown in Tables VIII and IX gives great difficulty in interpretation and one is only justified in giving an equivocal report on such findings, for normal sera may occasionally react in this manner.

Tables VIII and IX do show clearly, however, that the fixation value of the one antigen is not much greater than that of the other. Thus Table VIII shows the simple antigen to be rather more active than the frozen antigen in 12 instances and in 8 of these the microscopical examination was positive, while Table IX shows the reverse, there being 9 instances in which the frozen antigen gave greater fixation than the simple antigen, and in 4 of these the microscopical examination was positiye.

In only 3 tests then out of a series of 300 would a negative have been given in place of a positive report, and in 9 tests a negative in place of a "doubtful" report had the test been limited to the simple antigen. This finding shows that the test can quite well be carried out with the simple antigen alone and that the frozen antigen does not for practical purposes exhibit any advantage over it.

IV.—Is it necessary to Absorb the "Human Sera to be Tested" with the Cells of the Hæmolytic Couple prior to carrying out the Reaction?

Theoretically there should be no need to absorb "the sera to be tested" in this way prior to carrying out the reaction, for if in the first phase of the test proper *all* the complement be deviated then the extra sensitization of the cells of the hæmolytic system by non-specific bodies in the serum to be tested, is of no real significance.

Observations bearing upon this question were made and the results obtained clearly indicate that previous absorption of the test sera is unnecessary. The findings completely bear out those of Wilson, Forbes, and Schwartz, *Journal of Immunology*, viii, No. 2, March, 1923, p. 105.

V.—Relation of the Gonococcus Fixation Test to the Wassermann Reaction.

In the series under discussion eighty-eight of the sera were tested by the Wassermann reaction at or about the same time as the gonococcus fixation tests were performed. In forty-seven of these the Wassermann test was positive, and of these :—

(*a*) The Wassermann was positive and the gonococcus fixation positive in fifteen.

(*b*) The Wassermann was positive and the gonococcus fixation negative in thirty-two.

(*c*) In fifteen cases the Wassermann was negative and the gonococcus fixation positive.

(*d*) In the remaining twenty-six both reactions were negative.

There is, therefore, a positive agreement in 15 cases, and a negative agreement in 26, but among the 62 tests where one or other was positive there is agreement only in 15 and a *positive* disagreement in 47. Moreover in 12 of the 15 cases in which both fixation test and Wassermann were positive there was unequivocal evidence from microscopical examination that the cases were gonorrhœal. There is, therefore, no evidence that a serum giving a positive Wassermann also gives a non-specific fixation in presence of the gonococcus antigens employed in these tests.

VI.—Cases Demanding Special Consideration.

The following twelve cases are of interest for a variety of reasons. As they do not readily lend themselves to grouping each will be commented upon separately. The results of examination in these twelve cases are shown graphically in this section (*a*) to (*e*).

(*a*) Ref. No. 4428 ; sex female.

(i) Microscopical examination of cervical smear March 17, 1923, positive.

(ii) Wassermann, March 21, 1923, doubtful.

(iii) Fixation tests :—

Date	Frozen antigen		Simple antigen		No antigen		Vaccine treatment and remarks
	Quantity of serum		Quantity of serum		Quantity of serum		
	0·025	0·05	0·025	0·05	0·025	0·05	
21.3.23	—	+	—	+	—	—	Nil
26.4.23	—	—	—	—	—	—	600 millions sensitized vaccine
30.5.23	—	—	—	—	—	—	2,300 ,, ,, ,,
27.6.23	—	—	—	—	—	—	15,000 ,, ,, ,, last dose 18.6.23

As the strain used for preparing the vaccine was the same as that used for the antigen in the tests the only conclusion one can come to is that this patient is constitutionally unable to react to the infection or to the vaccine.

(*b*) Ref. No. 5160; sex female.

(i) Wassermann reaction, February 28, 1923, positive.

(ii) Microscopical examination negative, cervical and urethral, April 5, 1923.

(iii) Microscopical examination negative, cervical, April 14, 1923.

(iv) Complement fixation tests:—

Date	Frozen antigen		Simple antigen		No antigen		Vaccine treatment and remarks
	Quantity of serum		Quantity of serum		Quantity of serum		
	0·025	·05	0·025	0·05	0·025	0·05	
14.3.23	–	–	–	–	–	–	
11.4.23	++++	++++	++++	++++	–	++	Antihæmolytic; value of test really nil
18.4.23	–	+	++	+++	–	–	Feeble reaction
20.6.23	–	–	++++	++++	–	–	Reaction with one antigen only

This is a very doubtful case, and although there is some clinical ground for believing that the case is one of gonorrhœa, the evidence is not overwhelming and the results of April 18, 1923, and June 20, 1923, might be regarded critically as errors of the test on the positive side.

(*c*) Ref. No. 5966; sex female.

(i) Wassermann test doubtful, April 4, 1923.

(ii) Microscopical examination positive, March 29, 1923.

(iii) Complement fixation tests:—

Date	Frozen antigen		Simple antigen		No antigen		Vaccine treatment and remarks
	Quantity of serum		Quantity of serum		Quantity of serum		
	0·025	0·05	0·025	0·05	0·025	0·05	
4.4.23	–	++	–	–	–	–	
16·5.23	++	++	++	++++	–	–	600 millions sensitized vaccine
13.6 23	–	–	–	–	–	–	4,700 do., last dose 5.6.23
27.6.23	–	–	–	–	–	–	6,700 do., ,, 12.6.23
25.7.23	++++	++++	++++	++++	–	–	12,700 do., ,, 17.7.23

The special interest of this case lies in the negative results of June 13, 1923, and June 27, 1923, as indicating the possibility of a negative phase occurring during the course of vaccine treatment. It is to be noted that neither on June 13 nor on June 27 did the results obtained with other sera tend to suggest that the complement used on these days was exceptionally undeviable.

(*d*) Ref. No. 6028; sex female.

(i) Wassermann test negative, July 5, 1922.

(ii) Vaginal smear negative microscopically, July 6, 1922.

(iii) Complement fixation reactions:—

Date	Frozen antigen Quantity of serum		Simple antigen Quantity of serum		No antigen Quantity of serum		Vaccine treatment and remarks
	0·025	0·05	0·025	0·05	0·025	0·05	
8.3.23	++++	++++	0	0	—	—	Only 1·5 m.h.d. of complement used
9.5.23	—	—	—	—	—	—	450 millions sensitized vaccine
25.7.23	++++	++++	++++	++++	—	—	1,800 do., last dose 22.5.23

This case was treated by vaccines on clinical grounds alone, for the deviation of March 8, 1923, was in presence of only 1·5 m.h.d. of complement. From the diagnostic viewpoint nothing can be said of the reactions, but assuming that the case is not one of gonorrhœa, it is interesting to note that a positive reaction persists in some cases for at least two months after vaccine treatment.

(*e*) Ref. No. 6321; sex female.

(i) Microscopical examination, vaginal and cervical both positive, December 2, 1922. Discharge persisted until June, 1923.

(ii) Wassermann test negative, November 29, 1922.

(iii) Complement fixation reactions:—

Date	Frozen antigen Quantity of serum		Simple antigen Quantity of serum		No antigen Quantity of serum		Vaccine treatment and remarks
	0·025	0·05	0·025	0·05	0·025	0·05	
11.4.23	—	—	—	—	—	—	600 millions sensitized vaccine
16.5.23	—	—	—	—	—	—	9,000 ,, ,, ,,
13.6.23	—	—	—	—	—	—	
18.7.23	—	—	—	—	—	—	

The above is an example of a case in which, notwithstanding fairly active vaccine treatment, no complement fixing antibodies were produced within three months.

(*f*) Ref. No. 6352; sex female.

(i) Microscopical examination, November 30, 1922, cervical, negative.

(ii) Wassermann test positive, January 3, 1923.

(iii) Complement fixation reactions:—

Date	Frozen antigen Quantity of serum		Simple antigen Quantity of serum		No antigen Quantity of serum		Vaccine treatment and remarks
	0·025	0·05	0·025	0·05	0·025	0·05	
4.1.23	++++	++++	++++	++++	++++	++++	Antihæmolytic; no report can be given
18.1.23	++++	++++	++++	++++	++	++	Antihæmolytic; no report can be given
9.5.23	—	++	—	++	—	—	Doubtful
16.5.23	++++	++++	++++	++++	—	—	

The main interest of this case lies in the fact that although there was strong presumptive evidence of gonorrhœa, yet microscopical examination was negative. Of secondary importance is the notable anticomplementary or antihæmolytic quality of the serum noted on two successive examinations with an interval of a fortnight between each test.

(*g*) Ref. No. 6433 ; sex female.

(i) Microscopical examination, cervical and urethral, negative, January 6, 1923.

(ii) Microscopical examination, April 19, 1923, cervical, positive.

(iii) Wassermann test, January 10, 1923, negative.

(iv) Complement fixation tests :—

Date	Frozen antigen		Simple antigen		No antigen		Vaccine treatment and remarks
	Quantity of serum		Quantity of serum		Quantity of serum		
	0·025	0·05	0·025	0·05	0·025	0·05	
11.1.23	–	–	–	–	–	–	
9.5.23	–	++++	++	++++	–	–	
13.6.23	–	–	–	–	–	–	6,800 millions sensitized vaccine 31.5.23
20.6.23	–	–	–	–	–	–	No further vaccine treatment
18.7.23	++++	++++	++++	++++	–	–	

This recalls case (*c*) in which there is a similar period during which the reaction was negative after vaccine treatment.

(*h*) Ref. No. 6465 ; sex female.

(i) Microscopical examination cervical, positive, March 28, 1923.

(ii) Wassermann test positive, January 24, 1923.

(iii) Complement fixation reactions :—

Date	Frozen antigen		Simple antigen		No antigen		Vaccine treatment and remarks
	Quantity of serum		Quantity of serum		Quantity of serum		
	0·025	0·05	0·025	0·05	0·025	0·05	
14.3.23	+	+	++++	++++	–	–	
28.3.23	++++	++++	++++	++++	–	–	
9.5.23	–	–	–	–	–	–	
20.5.23	++++	++++	++++	++++	–	–	
25.7.23	++++	++++	++++	++++	–	–	700 millions sensitized vaccine, last dose 28.6.23

This case shows a fairly persistent positive reaction over the whole period with the exception of the test made on May 9, 1923. On this date the peculiar result may have been due to technical error, but on the other hand it is well known that in chronic infections of all kinds the serologic picture is liable to vary from week to week and even from day to day.

(*i*) Ref. No. 6458; sex female.

(i) Microscopical examination, cervical, January 18, 1923, negative.

(ii) Wassermann test, January 24, 1923, negative.
(iii) Complement fixation tests :—

Date	Frozen antigen		Simple antigen		No antigen		Vaccine treatment and remarks
	Quantity of serum		Quantity of serum		Quantity of serum		
	0·025	0·05	0·025	0·05	0·025	0·05	
25.1.23	—	—	—	—	—	—	
8.3.23	—	—	—	—	—	—	
4.4.23	—	—	—	—	—	—	
16 5.23	—	—	—	—	—	—	
13.6.23	—	—	—	—	—	—	2,400 millions sensitized vaccine, last dose 28.5.23

(*j*) Ref. No. 6494 ; sex male.
(i) Microscopical examination urethral, positive, February 3, 1923.
(ii) Wassermann test, not done.
(iii) Complement fixation reactions :—
(*a*) Positive with both antigens and with both concentrations of serum on March 29, 1923.
(*b*) Negative on June 6, 1923, after 8,000 millions sensitized vaccine. This result of June 6, 1923, may perhaps represent a negative phase as the test was made shortly after the final dose of the course of vaccine.

(*k*) Ref. No. 6548 ; sex female.
(i) Microscopical examination cervical, negative, March 20, 1923.
(ii) Microscopical examination cervical, positive, March 28, 1923.
(iii) Wassermann reaction positive, March 14, 1923.
(iv) Complement fixation reactions :—

Date	Frozen antigen		Simple antigen		No antigen		Vaccine treatment and remarks
	Quantity of serum		Quantity of serum		Quantity of serum		
	0·025	0·05	0·025	0·05	0·025	0·05	
25.4.23	—	—	—	—	—	—	
13.6.23	—	—	—	—	—	—	700 millions sensitized vaccine, last dose 2.6.23.
18.7.23	—	—	—	—	—	—	5,000 millions sensitized vaccine, last dose 14.7.23.

This case appears to be of the same type as (*a*) and (*e*), exhibiting a peculiar inability to react to infection or to vaccine.

Ref. No. 6597.
(i) Microscopical examination cervical, negative, March 29, 1923.
(ii) Microscopical examination cervical, positive, April 3, 1923.
(iii) Complement fixation with both antigens positive in presence of both 0·025 and 0·05 cubic centimetre of serum.
(iv) Wassermann test negative, April 3, 1923.
(v) Complement fixation negative with both antigens, May 9, 1923, after patient had received 1,800 millions sensitized cocci.

(vi) Complement fixation again negative with both antigens, June 6, 1923, after patient had received 4,500 millions sensitized cocci, the last dose of 2,000 million being given May 28, 1923.

(vii) Complement fixation negative a third time on June 27, 1923, after 5,000 million, the last dose being 2,500 million, given June 17, 1923.

(viii) Bartholinian abscess opened and pus examined. Contained large numbers of Gram-negative cocci.

(ix) Complement fixation test negative, July 25, 1923, after patient had received 11,000 millions sensitized vaccine, the last dose being one of 2,500 millions given on July 9, 1923.

This is a remarkable case, for the case having once become positive, April 3, 1923, one would have expected it to remain positive so long as infection continued. Moreover, with the development of a Bartholinian abscess one would certainly have expected the reaction to be positive after vaccine treatment. Finally, even large doses of vaccine in this case did not call forth the production of complement fixing antibodies.

These, then, represent the peculiar sera encountered in the examination of 314 cases—about four per cent.

VII.—Technique now Used.

(*a*) *Human Sera to be Tested.*—The blood to be tested should be sent to the laboratory as soon as possible after collection. The blood is allowed to clot and the serum separated by centrifugalization. The clear serum is pipetted off and is at once inactivated at 56° C. for twenty minutes in a water bath; it is then stored at or below 0° C. till the day of the test, when it is again inactivated for twenty minutes at 56° C., whereupon it is ready for distribution.

(*b*) *Complement.*—The complement is that of guinea-pig serum and the serum of at least three guinea-pigs should be pooled for use, so that the error arising from variation in the deviability of complement from different animals may as far as possible be eliminated.

The animals are killed on the day before the test is to be made by cutting the throat and the blood is collected; the serum from each is pooled and to each cubic centimetre of serum is added 0·1 cubic centimetre of centrifuged deposit of sheep red cells. This mixture of complement and red cell cream is allowed to stand overnight in the ice chest and is centrifuged the following morning.

(*c*) *Preparation of Simple Antigen.*—The antigen is prepared exactly according to the method described in the previous report and consists of a suspension of gonococci obtained by washing off a "six-hour" culture of the organism with saline and standardizing the suspension so obtained that it contains 500 million cocci per cubic centimetre. It is to be noted that certain strains of the gonococcus cannot be used because of their marked anticomplementary quality and care should be taken to choose a strain which is (*a*) representative of the predominant serological type; and (*b*) does not

develop this anticomplementary quality in its growth at least to such an extent that suspensions containing 500 million cocci per cubic centimetre interfere to any extent with the activity of complement.

Unless a refrigerator is available the antigen should be made fresh each time that a series of tests is being carried out, but if kept frozen its qualities remain unimpaired for at least three months.

Full particulars of the culture media employed, (1) for growing the cultures destined for use as antigen, and (2) for maintaining stock cultures, are given in the previous report (Vol. XLI, No. 6, pp. 432-438).

(*d*) *Preliminary Test of Activity and Absence of Non-specific Deviability of Complement.*—Into two series of eight tubes are introduced the following reagents—one series will be referred to as Series A and the other as Series B. The complement is diluted 1 in 24 in saline.

	1	2	3	4	5	6	7	8	
Complement 1 in 24	0·075	0·1	0·125	0·15	0·175	0·2	0·225	0·25	Both A
Saline	0·175	0·15	0·125	0·1	0·075	0·05	0·025	*nil*	and B

To each tube of Series A is added 0·25 cubic centimetre of the 500 million antigen and to each tube of Series B is added 0·25 cubic centimetre of saline.

Both series are incubated in the dry incubator at 37° C. for two hours, after which 0·25 cubic centimetre of 2½ per cent suspension of sheep red cells sensitized with 2 m.h.d. of antisheep cell serum is added to each and incubation in a water bath continued at 38° C. for thirty minutes when readings are taken. There should be the same degree of hæmolysis in Series A in presence of antigen as there is in B, i.e., in absence of antigen. Thus if Tube 3 of Series B shows complete lysis, Tube 3 of Series A should also show complete or almost complete lysis. If it does not, either the complement is non-specifically deviable or the antigen is anticomplementary. Sometimes by diluting the antigen still further this difficulty can be overcome but in doing so care must be exercised for there is danger of over-dilution of this reagent. As a matter of fact, with a suitable strain of the coccus this difficulty does not arise and after a little experience the dilution of antigen required is obtained with no difficulty.

It has been my experience that when the complement gives complete lysis in Tubes 1, 2, 3, or 4, the results are more clear-cut and more reliable than when lysis occurs only in Tubes 5, 6, 7, or 8, and beyond the limit of activity represented by Tube 8 the results are frankly unreliable. On the above titration the following quantities are required for twelve tests, including controls, using 2 m.h.d. per test and testing with two dilutions of serum.

	Complete lysis in							
	Tube 1	Tube 2	Tube 3	Tube 4	Tube 5	Tube 6	Tube 7	Tube 8
Complement ..	0·3	0·4	0·5	0·6	0·7	0·8	0·9	1
Saline	11·7	11·6	11·5	11·4	11·3	11·2	11·1	11

(*e*) *Hæmolytic System.*—The hæmolytic system consists of a 2½ per cent suspension of washed sheep red cells sensitized with 2 m.h.d. of antisheep

corpuscle serum, the latter being standardized by the method used therefore in the Fildes-McIntosh technique for conducting the Wassermann test (Medical Research Council, Special Report Series, No. 19).

The cells should be sensitized at once after the preliminary test of complement has been put into the incubator.

(*f*) *The Test Proper.*—For each serum four tubes are required and it is convenient to have metal racks, each with two rows of holes for holding the tubes. Into one tube in the front row and into the corresponding tube in the back row there is pipetted 0·025 cubic centimetre, and into the second tube of each row there is pipetted 0·05 cubic centimetre of the serum (inactivated) to be tested. To the front row tubes 0·25 cubic centimetre of saline is added and to the back row tubes 0·25 cubic centimetre of antigen. To each of the four tubes is now added 0·25 cubic centimetre of complement of the requisite dilution containing 2 m.h.d.

The racks containing the tubes are put into the incubator at 37° C. for two hours and then to each tube is added 0·25 cubic centimetre of the hæmolytic system, and finally the tubes are incubated in a water bath at 38° C. for one hour when the readings are taken.

The tubes of the front row should show *complete lysis*, for the least degree of anticomplementary quality exhibited by the serum alone is sufficient to influence the specificity of the reaction.

The convention used for denoting the results is that employed throughout this communication:—

+ + + +	means	complete fixation.
+ + +	,,	almost complete fixation.
+ +	,,	marked fixation but lysis about thirty per cent.
+	,,	fifty per cent lysis.
–	,,	complete lysis.

Conclusions.

(1) A fairly reliable and simple method of conducting the complement fixation reaction in gonorrhœa is described.

(2) The test can be made using only 0·025 and 0·05 of the serum under examination in place of 0·0125, 0·025, 0·05 and 0·1 cubic centimetre, as described in the previous communication, without seriously detracting from the value of the test.

(3) The quantity of complement to be deviated can be increased from 1·5 m.h.d. to 2 m.h.d. This increase does not render the test much less delicate and it does increase the margin of safety so that false positive results are not liable to be given.

(4) Antigens prepared by simply suspending very young cultures of the gonococcus in saline act as satisfactorily as do antigens prepared by alternate freezing and thawing with liquid air.

(5) Absorption of the sera to be tested by the cells of the hæmolytic couple prior to actually performing the test is not necessary.

(6) There is no evidence of a non-specific fixation of complement by syphilitic sera in presence of gonococcus antigen.

(7) The development of a positive reaction in acute gonorrhœa, in absence of vaccine treatment, is indicative of a serious local extension of the infective process.

(8) In cases of blood invasion with joint involvement the reaction appears always to be positive and the same is true of (gonorrhœal) epididymitis and orchitis.

(9) The main value of the test is its application to the diagnosis of chronic gonorrhœa in the female where microscopical examination is often difficult and unsatisfactory owing to the accompanying flora, so that repeated examination of smears is often required to exclude infection with the gonococcus. In many such cases the fixation reaction gives very valuable information and in such circumstances it appears more useful than is microscopical or cultural examination of the discharges.

Note.—In several instances in the female cases quoted in this report the positive result obtained by fixation was only verified later by demonstration of the gonococcus in the discharges, and that, often, only after several examinations had been made.

It is to be especially noted that the microscopical examinations were carried out by Dr. W. Cumming of this laboratory who had no access to the results of the fixation test, that test being made by me personally, the findings of each observer being correlated only on completion of the investigation.

AN INSTRUCTIONAL MEDICAL EXERCISE.

By Colonel E. T. F. BIRRELL, C.B., C.M.G.

This exercise, which is based on one of the winter schemes of the 8th Infantry Brigade for 1922, was originally drawn up for the instruction of majors, Royal Army Medical Corps, serving in the South-western Area, Southern Command, who were preparing for examination for promotion to lieutenant-colonel. It is designed to be worked out with the aid of maps, without reconnaissance of the ground, as the officers could not easily have visited the actual places. The practice was to issue a task for the officers to work out; their work was then gone over and criticized, and given back to them with the notes on the task (which have no pretentions to be the correct or only solutions) for further study, together with the next task. This system of instruction was found quite satisfactory.

The exercise, which has now been revised in accordance with Field Service Regulations, vol. I, 1923, and the Provisional War Establishments of June 1, 1923, is published in the hope that it may be of service to other officers of the Corps preparing for examination for promotion to lieutenant-colonel.

I am indebted to Major B. L. Montgomery, D.S.O., late Brigade Major, 8th Infantry Brigade, for the use of the Brigade winter scheme and for adding Divisional situations to it, and for valuable assistance in converting it to a medical exercise.

References.—Provisional War Establishments, Parts XXIII A, XXIV A, XXV A, and XXVI A, June 1, 1923; Field Service Regulations, vol. I, 1923; Field Service Regulations, vol. II, 1920 (especially Chapter VI, Operation Orders); Training and Manœuvre Regulations, 1913 (especially Section 14, Appreciations); and R.A.M.C. Training, 1911.

General Idea.

Reference ¼ inch O.S. Map, Sheet 8.

Eastland (Devonshire) and Westland (Cornwall) are two independent states. The exact boundary between them is the River Lynher as far as Altarnum, thence to Boscastle. The most important towns in these states are their respective capitals, Exeter and Truro.

The relations between Eastland and Westland have been strained for some years. War seemed inevitable, and finally on August 8, 1923, Eastland declares war on Westland.

Each state can mobilize two divisions, one cavalry brigade, one tank battalion and one squadron, Royal Air Force, in a few days; other troops can be made available after a delay of some weeks.

The moral and armament of the armed forces of Eastland are similar to the British Army; those of the Westland forces are similar to the German Army (1918).

FIRST SCHEME.

Special Idea.

Reference 1 inch O.S. Map, Sheets 140, 148.

On August 8, simultaneously with the declaration of war, Eastland ordered a general mobilization. Her plan was to mobilize as rapidly as possible one cavalry brigade and one infantry brigade group, and to concentrate them at Tavistock in order to protect the frontier and cover the concentration of the Eastland forces. The southern flank was secured by the defences of Devonport and Saltash, which were strongly garrisoned.

General headquarters, Eastland (at Exeter), in preparing the general plan of their offensive against Westland, informed the director of medical services that the Army is intended to advance in the direction of Liskeard and that Devonport is to be the advanced base. It was decided that the Military Hospital, Devonport, is to be immediately expanded to the equivalent of a general hospital of 600 beds, and an assistant director of medical services, advanced base, is to be appointed. Devonport is regarded as unlikely to be seriously threatened, but general headquarters will not agree to more hospitals than the one general hospital being opened there. The 3rd Division will detrain at Tavistock, and the other division at some point north of Tavistock. Tavistock will be railhead for the 3rd Division and 1st Cavalry Brigade, Tavistock or a station north of it for the other division.

Two casualty clearing stations, three more general hospitals, two ambulance trains and two motor ambulance convoys are to be mobilized immediately. Steps are to be taken to form additional war hospitals in the interior of Eastland. The medical base will be Exeter and its neighbourhood.

The lines of communication (railheads inclusive) will be administered as one area, with a deputy director of medical services on the headquarters of the commander. General headquarters, in consultation with the commander, lines of communication area (headquarters at Exeter), when deciding the organization of the more forward portion of the lines of communication, asked the director of medical services for his proposals.

Required.

First Task. Preliminary Arrangements.

As director of medical services, Eastland, state your proposals for the distribution of the two casualty clearing stations and the two motor ambulance convoys now to be mobilized.

Notes on First Task.

(i) The information is purposely partly indefinite. Officers in high administrative appointments must be capable of making contingent plans, easily alterable in detail, and, if necessary, in general. The director of medical services should interview the general staff and the quartermaster-general's branch of the staff and question them from his point of view,

consult with the deputy director of medical services and the commander, lines of communication area, and then see the commander-in-chief.

(ii) The director of medical services can make definite plans for the 3rd Division and 1st Cavalry Brigade, tentative for the other division. For example, he can propose:—

(*a*) Casualty clearing stations—one to be opened at Tavistock when the 3rd Division detrains there, the other to be held ready to go wherever may be best. It is not known how the other division will be supplied, i.e., north or south of Dartmoor. It might be best to locate the second casualty clearing station at the second railhead, if so much to the north of the 3rd divisional railhead that it will not be supplied through Devonport. On the other hand, Tavistock through Devonport might serve both divisions, and the second casualty clearing station might be required later to move forward and act as a stage between the field formations and railhead.

(*b*) Motor ambulance convoys. Similarly one could be based on Tavistock, the other held in reserve, probably at Devonport, so as to be sent forward where and when required.

(*c*) The assistant director of medical services, advanced base, should also administer Tavistock. Whether he should administer the other railhead or not cannot be decided at present.

Required.

Second Task. Special Arrangements.

(1) As director of medical services, Eastland, having formulated your proposals in accordance with the first task, state your requirements in the way of medical store depots, laboratories, and sanitary units for the immediate service of the field troops, with their proposed distribution.

(2) State what arrangements you will make, in the forward portion of the lines of communication, for dental treatment of the field troops to supplement the dental service with the medical units, assuming that you have available for this purpose at present four officers and six other ranks (including four dental mechanics), Army Dental Corps, with field dental equipment and dental mechanics' equipment in proportion.

Notes on Second Task.

(1) (i) Medical supplies would conform to the general supply route; but it is "in the air" whether Devonport will be the only channel, or if supplies for the other division will come north of Dartmoor. The director of medical services is not necessarily limited in the number and category of medical store depots he can form. He could propose a base medical store depot at Devonport, with an advanced medical store depot at Tavistock and another at the second railhead. Or if general headquarters, or the commander, lines of communication area, consider this too much accumulation of heavy stores near the front, an advanced depot at Devonport with a "dump" attached to the casualty clearing station at Tavistock and another at the other railhead.

(ii) A mobile bacteriological laboratory at Tavistock, and one mobile hygiene laboratory at Devonport ready to go where required should suffice for the needs of the field troops for the present. A second mobile bacteriological laboratory should be ready in case the other division requires a separate service. A base laboratory (hygiene and pathology) will no doubt be formed at Exeter or near there.

(iii) A sanitary section (lines of communication) at Devonport, supplemented by civilian labour, a detachment at Tavistock, and a second detachment in readiness for the other railhead (temporarily at Tavistock or Devonport) should suffice for the present.

(2) The field troops are provided with a dental service for immediate purposes, attached to field ambulances, and for supply or repair of dentures casualty clearing stations and general hospitals have the necessary personnel and equipment. But a casualty clearing station and a 600-bedded general hospital, as at Devonport, have only one dental mechanic each, and larger dental workshops will be required, and these should be as near the front as will suit the general situation. The casualty clearing stations can conveniently treat the slighter class of denture case, i.e., those requiring a brief period of treatment, but at this stage it is impracticable to retain so near the front cases requiring prolonged treatment. These might go on to Devonport, where the dental service with the general hospital could be reinforced by two of the dental officers, three dental mechanics, and a clerk orderly, with equipment in proportion (the remaining personnel and equipment to be kept in reserve for future developments), to form a dental centre capable of dealing with the greater part of denture work for the field troops, and so avoid sending dental cases farther down the lines of communication. Whilst waiting for dentures, men unfit to return to the front line could be employed at the advanced base.

REQUIRED.

Third Task. Medical Policy.

(1) The appointment of the following consultants has been approved: two consulting surgeons, one consulting physician.

State in what areas of the theatre of war you would employ them.

(2) Draft instructions for issue to the medical service laying down the policy, as regards evacuation, to be observed in dealing with the following classes of casualties: (*a*) wounds of the chest and abdomen, (*b*) wounds of the head, (*c*) gunshot fracture of the femur, (*d*) wounds of the eye, (*e*) dental cases.

Notes on Third Task.

(Although this task is not exactly within the syllabus of the examination, it serves to complete the medical plans of campaign.)

(1) To ensure the best results for the wounded, expert surgical opinion at the earliest possible moment is obviously necessary; therefore one surgical consultant should be allotted for the front, the other should

supervise surgical work at the base. Devonport would probably be the best centre for the forward consultant, visiting casualty clearing stations and field ambulances as required; the other should visit the base hospitals. They should meet each other and the director and deputy director of medical services frequently.

The consulting physician would probably be best employed normally at the base, but should also visit the front, and be in close touch with the director and deputy director of medical services.

(2) The general medical policy would be to treat cases (*a*) especially, and also to a less extent (*b*) and (*c*) as near the place where they became casualties as possible, to collect (*d*) in some hospital where expert ophthalmic surgeons could deal with them, and to keep (*e*) as near the front as might be possible. But the director of medical services should not issue his detailed instructions without consulting the staff, as there may be military reasons why severely wounded or any class of medical casualty should not be retained near the front. The task is designed to bring out this point.

For cases that should not be evacuated farther than is essential to obtain the best treatment, there is the casualty clearing station at Tavistock and the general hospital at Devonport, ambulance convoys and trains for their transport, and the Tamar is navigable in its lower part.

Assuming that there are no present military objections, he should give instructions for cases (*a*) to be sent to Tavistock and retained there until fit to travel, i.e., for about three weeks at least. He should arrange that the casualty clearing station be reinforced as necessary from the lines of communication. Cases (*b*) and (*c*) should go to Devonport, preferably by water transport, and (*d*) to a selected hospital in Eastland. Class (*e*) requires special consideration. Reservists will supply most of the dental cases and many of them will be found to need dentures or repair of dentures. Probably the best plan would be to have a large dental workshop at the advanced base as suggested in the notes on second task.

SECOND SCHEME.

Special Idea.

Reference 1 *inch O.S. Map, Sheets* 140 *and* 148.

The 1st Cavalry Brigade was mobilized rapidly and sent forward (accompanied by the 1st Cavalry Field Ambulance) to the frontier, which it reached on August 14. Its orders were:—

(i) To make good the line of the River Lynher as far north as North Hill. From that place northwards the frontier was being guarded by frontier guards and local volunteer units.

(ii) To reconnoitre the roads leading west from the river with a view to finding out the enemy's dispositions and strength, and to prevent enemy patrols gaining information about the movements of the Eastland forces.

At 09.00 hours on August 14, the 8th Infantry Brigade Group (which included the 8th Field Ambulance) detrained at Tavistock.

The orders of the brigade group commander were:—

(*a*) To protect the main river crossings over the frontier in rear of the cavalry screen, with a view to forming rallying points for the cavalry should they be driven in.

(*b*) To cover the forward concentration of the 3rd Division preparatory to an invasion of Westland from Tavistock.

The assistant director of medical services, advanced base (Devonport), received a message at 08.00 hours on August 14, from the deputy director of medical services, lines of communication area, to arrange with the 1st Cavalry Brigade and 8th Infantry Brigade for the evacuation of their casualties. He was informed by headquarters, advanced base, as to the rôle of the 1st Cavalry Brigade and 8th Infantry Brigade Group.

One ambulance railway coach (holding twenty patients lying or forty sitting) and two ambulance cars of an auxiliary motor ambulance company were available at Devonport, where there was also one sanitary section.

Required.

Fourth Task. Rearward Services.

(1) As assistant director of medical services, advanced base, write an appreciation of the situation as affecting evacuation from the 8th Infantry Brigade Group, including evacuation from the 1st Cavalry Brigade, as at 09.00 hours, August 14.

(2) As assistant director of medical services, advanced base, write a message to the officer commanding 8th Field Ambulance, informing him how his casualties will be cleared.

Notes on Fourth Task.

(1) The appreciation required is designed to bring out:—

(i) Knowledge of organization—the assistant director of medical services, advanced base, cannot give orders to the 8th Field Ambulance. The arrangement that the advanced base is to clear casualties from the field troops must have been notified by general headquarters to the 1st Cavalry Brigade, and through the 3rd Division to the 8th Infantry Brigade.

(ii) He has to arrange for his garrison sick (strength of garrison not stated in the scheme) as well as casualties from field troops totalling about 7,000, the daily sick requiring admission to hospital averaging probably ten (one half of an average daily sick rate of 0·3 per cent). Fighting is not likely to occur for a day or two, but in that event the field troops might lose five per cent in battle casualties, i.e., by the usual formula five per cent of three-fifths of 7,000 = 210 battle casualties, of which 169 would be wounded, or say between 150 and 200 wounded. He has ample ambulance transport for the sick of the field troops, but will need more ambulance transport if fighting occurs. The field troops have sufficient ambulance transport for the present.

(iii) The general hospital can deal with any kind of casualty, but presumably must be kept fairly clear for battle casualties.

(iv) As a practical measure he should go and see headquarters, 8th Infantry Brigade, arrange for the cavalry casualties to come through them, find out what they want, and tell them what he can do.

(2) The message he has to write must show what the field ambulance should do as well as what will be done for it, e.g., the point to which the ambulance should send casualties, and the approximate time and manner in which they will be cleared. He should also specify any detachments which the ambulance should make for this purpose, or detachments that will be sent up from Devonport to take over pending evacuation, the latter being the preferable arrangement.

Special Idea (Second Scheme) continued.

The frontage allotted to 8th Infantry Brigade was from Golberdon (2½ miles north-west of Callington) to Clapper Bridge (three miles south of Callington), both river crossings inclusive.

The mobilization of the Westland forces was known to be proceeding apace. Up to August 13 no troops had been observed east of the line Liskeard—Camelford, with the exception of a few weak cyclist patrols.

On arrival of the 8th Infantry Brigade Group at Tavistock on the morning of August 14, it was reported by agents that troops had detrained at Bodmin and Wadebridge the evening before. This was confirmed by aircraft reports, which also stated that troops had been observed on the roads moving eastward from these two places early on August 14. Hostile aircraft were observed over Tavistock at 08.30 hours, August 14.

Order of Battle.

8th Infantry Brigade Group.

Headquarters, 8th Infantry Brigade.
8th Brigade Signal Section.
15th Brigade, R.F.A.
1 Section "A" Echelon D.A.C.
8th Field Company, R.E.
1st Bn. Devonshire Regiment.
2nd Bn. King's Own Scottish Borderers.
2nd Bn. Royal Berkshire Regiment.
2nd Bn. South Staffordshire Regiment.
8th Field Ambulance.
No. 3 Company, 3rd Divisional Train.
"A" Company, 1st Tank Division.

The following operation order was issued by the brigade group commander:—

SECRET.
Copy No.

8TH INFANTRY BRIGADE/ORDER No. 6.

August 14, 1923.

Reference 1-inch O.S. Map, Sheet 148.

(1) (*a*) Aircraft report small bodies of enemy troops moving eastward from Bodmin and Wadebridge this morning. (*b*) The positions of our troops remain unchanged.

(2) The 8th Infantry Brigade Group will establish outposts to cover the forward concentration of the 3rd Division, and to protect the main river crossings over the frontier in rear of the cavalry screen.

(3) (*a*) *Outpost Line.*—Right sector: 1st Battalion Devonshire Regiment, Tredwoodloe (inclusive) to spur just north-west of Frogwell (exclusive). Left sector: 2nd Battalion King's Own Scottish Borderers, spur just north-west of Frogwell (inclusive) to New Down (inclusive).

(*b*) *Outpost Line of Resistance.*—General line Golberdon—Trevigro—Frogwell—Amy Down.

(*c*) *In Reserve.*—2nd Battalion South Stafford Regiment, Downgate. 2nd Battalion Royal Berkshire Regiment, West Harrowbarrow.

(4) Officer commanding 15th Brigade, R.F.A., will select positions from which to cover the outposts and protect the river crossings. Liaison officers will be attached to each sector commander.

(5) No. 2 Company, 3rd Divisional Train, will remain at Tavistock. Baggage wagons will accompany units.

(6) 8th Field Company, R.E., "A" Company, 1st Tank Battalion and 8th Field Ambulance will move to Harrowbarrow.

(7) Reports to the Bell Inn, Harrowbarrow.

Issued at 09.30 hours.

(Sgd.) B.L.M. Major.
Brigade Major.
8th Infantry Brigade.

Copies to:—15th Bde., R.F.A.
8th Field Coy., R.E.
1st Bn. Devon Regt.
2nd Bn. K.O.S. Borderers.
2nd Bn. S. Stafford Regt.
2nd Bn. Royal Berks. Regt.
"A" Coy. 1st Tank Battn.
8th Field Amb.
No. 3 Coy. Train.
1st Cavalry Bde.
3rd Division.
Signals.
Staff Captain.
File.
War Diary.

REQUIRED.

Fifth Task. Front (Brigade Group).

As officer commanding 8th Field Ambulance, having received the message from the assistant director of medical services, advanced base, referred to in the fourth task, state your proposals for the disposition of your unit in view of 8th Infantry Brigade Order No. 6 of August 14, 1923.

Notes on Fifth Task.

(i) The officer commanding 8th Field Ambulance has to arrange for his brigade group, and may have to help the cavalry to clear their casualties. Fighting is expected in the near future. He must so dispose his unit as best to serve the troops holding the River Lynher and keep in touch with them, and also be able to clear or be cleared easily to the railway. On August 14 there will probably only be sick to collect and deal with, say fifteen from his brigade group (5,000 strong) and a few from the cavalry, of whom half may have to be evacuated. If fighting occurs he may have to deal with 150 or 200 wounded (see notes on fourth task).

(ii) The officer commanding 8th Field Ambulance may have to leave a detachment at Tavistock to dispose of sick and care for them until relieved from Devonport.

(iii) He should (*a*) send four stretcher-bearers with the 1st Battalion Devonshire Regiment and 2nd Battalion King's Own Scottish Borderers to assist the regimental medical officers and act as runners between the battalions and his unit, (*b*) arrange for early evacuation of casualties, e.g., by stationing one ambulance car in Callington and one at Amytree, informing the 1st Devons and 2nd K.O.S.Bs., (*c*) establish a main dressing station in Harrowbarrow.

(iv) He may expect calls from the 1st Cavalry Brigade to clear their sick from across the River Lynher.

(v) In the present situation he should be able to clear his dressing station to the railway, say, at Tavistock or other point selected by headquarters advanced base.

THIRD SCHEME.

Special Idea.

The concentration of the 3rd Division was completed by August 16, and it received orders to advance into Westland on August 17 with a view to occupying Liskeard. Early on August 16 the cavalry screen drew off to the north, clearing the front of the 8th Infantry Brigade, with a view to acting independently on the right flank during the advance on August 17.

The enemy was known to be massing in considerable strength about Liskeard; information from spies and through intelligence was to the effect that he intended to offer a very stubborn resistance at that place; aircraft reported on the evening of August 16 that entrenchments were being dug on the ground to the east of the town.

Owing to the proximity of the enemy the general officer commanding, 3rd Division decided to advance on a two-brigade front. The 7th and 9th Infantry Brigades were to pass through the 8th Infantry Brigade on the early morning of August 17, and were to advance on either side of the main Callington—Liskeard road, 7th Infantry Brigade on the north, 9th Infantry Brigade on the south, dividing line the main road inclusive to

7th Infantry Brigade. The 8th Infantry Brigade was to reform and follow in reserve along the main road.

Considerable resistance was encountered during the advance on August 17. The enemy disputed the crossing of the River Lynher, and after this had been forced he delayed the advance by dropping machine-gun posts which fought to the last.

By 15.00 hours the advance was brought to a standstill on the general line Middlehill—Trebeigh Wood—Westdown Wood—Quethiock. The divisional commander decided to halt on this line and to organize a determined assault on the enemy position at dawn on August 18. The main enemy position was on the general line Crows Nest—Fursdon—Merrymeet—Pengover Green—Trevartha.

At 15.00 hours on August 17, the general medical situation was as follows: The director of medical services was with general headquarters at Tavistock. The 1st Casualty Clearing Station and 1st Advanced Depot of Medical Stores under the assistant director of medical services, advanced base, had opened at Tavistock on August 16. The 1st Motor Ambulance Convoy at Tavistock was at the disposal of the director of medical services and employed in evacuating casualties of the 3rd Division to the casualty clearing station at Tavistock.

The field ambulances of the 3rd Division were located as follows: 8th Field Ambulance parked in reserve at Callington; 7th Field Ambulance (which had been allotted to the area of 7th Infantry Brigade) main dressing station at Newbridge, advanced dressing station (one company) at Kenson; 9th Field Ambulance (which had been allotted to the area of 9th Infantry Brigade) main dressing station Amytree, advanced dressing station (a detachment waiting to clear the remaining wounded from the fighting early in the day) at Clapper Bridge, second advanced dressing station (one company) at Hammett.

The division had had 500 casualties, of whom 400 were wounded, most of them in the area of the 9th Infantry Brigade. All wounded were in process of being cleared to Tavistock, and the assistant director of medical services of the division required no additional ambulance transport.

During the action of 17th the enemy used gas shell (for the first time) about 14.00 hours, on the extreme left of the 9th Infantry Brigade, causing thirty casualties. As a result of a subsequent enemy counter-attack the medical officer of a battalion was reported missing, and the regimental medical equipment in enemy hands. A message to the above effect reached the assistant director of medical services from the 9th Field Ambulance at 15.00 hours.

Required.

Sixth Task. Front (Division).

As assistant director of medical services, 3rd Division, state what action you would take on receiving this message.

Notes on Sixth Task.

(i) Presumably general headquarters knew the enemy might use gas, and probably its nature. They would therefore have planned defensive measures and got material ready near the front. But they may not have had information. In any case the assistant director of medical services would immediately see the general staff and the quartermaster-general's branch, obtain any information available as to the probable greater use of gas by the enemy, and ask that stocks of fresh clothing, blankets, and chloride of lime be obtained, and material be provided for protecting dressing stations from gas where liable to be shelled. Divisional headquarters would no doubt warn all troops, report to general headquarters, and put defensive measures in train according to the arrangements made. The assistant director of medical services would warn field ambulances and give orders as to what material they could get, and where it is. He would inform the director of medical services of the occurrence and action taken or proposed, and ask for any special medical stores required for treatment, if not already supplied.

(ii) He would order the nearest or a selected field ambulance to detail an officer in replacement of the missing medical officer, and to send a supply of surgical dressings and, say, a medical companion to the unit pending replacement of the equipment.

(iii) To obtain early replacement of the officer and equipment and of any other casualty in the R.A.M.C., he should report the total personnel required to the director of medical services, and, as regards equipment, ask for a set of medical equipment for a unit to be sent forthwith to the battalion, indents to follow. He could assume that the director of medical services could order issue of the equipment from the medical stores at Tavistock.

(iv) He should ask the unit to indent through him for the equipment, informing the officer commanding meantime of the action taken.

SPECIAL IDEA (THIRD SCHEME) CONTINUED.

The following orders were issued for the attack (the assistant director of medical services was consulted as to paragraph 6).

SECRET.
Copy No.

3rd Division Order No. 2.

August 17, 1923.

Reference 1 inch O.S. Map, Sheet 148.

(1) (*a*) The enemy is holding a strongly entrenched position on the general line Crows Nest—Fursdon—Merrymeet—Pengover Green—Trevartha. (*b*) Our advanced troops have reached the line Middlehill—Trebeigh Wood—Westdown Wood—Quethiock.

(2) The 3rd Division will attack the enemy's position to-morrow morning.

(3) (*a*) The attack will be carried out by the 7th Infantry Brigade on the right and the 9th Infantry Brigade on the left. Dividing line: main Liskeard road, inclusive to 7th Infantry Brigade. (*b*) The attack will cross the following line at 06.00 hours August 18: road running north from Point 511—west edge of Trebeigh Wood—w in Tre*w*artha—2nd t in Trenan*t*. (*c*) First objective: the line Newton—g in Tren*g*rove—v in Tre*v*artha. Second objective: St. Cleer—Liskeard inclusive. The attack will leave the line of the first objective at 07.30 hours.

(4) The attack will be supported by 3rd Division artillery (artillery plan omitted).

(5) The 8th Infantry Brigade will be in reserve at Kenson, and will be prepared to move at half-an-hour's notice after 06.00 hours August 18.

(6) Advanced dressing stations will be established at Gang and St. Ive.

(7) Divisional headquarters will be at Kenson.

(8) Acknowledge.

(Sgd.). A. B. Lieutenant-Colonel,
General Staff, 3rd Division.

Issued at 16.30 hours.

Copies to:—7th Inf. Bde.
8th Inf. Bde.
9th Inf. Bde.
C.R.A.
C.R.E.
A.D.M.S.
Train.
Signals.
D.A.P.M.
"Q."
G.O.C.
File.
War Diary.

REQUIRED.

Seventh Task. Front (Divisional Attack).

(1) As assistant director of medical services, 3rd Division, write an appreciation of the situation in view of 3rd Division Order No. 2.

(2) Write an R.A.M.C. order for issue to your field ambulances in view of the above divisional order.

Notes on Seventh Task.

(1) (i) The assistant director of medical services knows how many wounded he had to deal with from the action August 17, and they are being evacuated. There may be a few left over as unfit to travel on the evening of 17th, but by next morning his field ambulances should be clear. If not, he can made temporaray arrangements for non-transportable cases and report to the director of medical services.

(ii) For next day's action strenuous fighting may be expected. He may have to deal with casualties at the rate of 10 to 15 per cent of the troops engaged. As the division (17,500) lost 500 on the 17th, his calculation of probable total casualties would be 10 or 15 per cent of three-fifths of 17,000 = 1,020 or 1,530, or say between 800 and 1,200 wounded.

(iii) For the first objective he can give fixed points for the medical

service, but for the second he can only have medical troops close behind the attacking troops ready to go forward and open farther advanced dressing stations as the action develops. In view of this, also, he should keep a medical unit in reserve, probably the 9th Field Ambulance, as it had most of the wounded and had difficulty in clearing on August 17. With this unit he can form main and advanced dressing stations farther forward as the attack proceeds. He will probably not require to bring up the ambulance in reserve until after 07.30 hours.

(iv) Should there be many walking wounded, he can ask the quartermaster-general's branch for lorry transport, otherwise his own transport may suffice.

(v) Prisoners of war may be available to help in clearing the field or in loading ambulance vehicles at dressing stations.

(vi) He has a main road to which to clear the field, and by which wounded can be evacuated to Tavistock by ambulance transport arranged by the director of medical services.

(2) Considering the above, and having asked the director of medical services to commence clearing the main dressing stations, say, an hour after action begins (or he may arrange direct with the motor ambulance convoy if the director of medical services has so ordered), he would frame his R.A.M.C. order as follows :—

SECRET.
Copy No.

3RD DIVISION R.A.M.C. ORDER NO. 2.

Issued Reference 3rd Division Order No. 2.

Reference 1 inch O.S. Map, Sheet 148.

August 17, 1923.

(1) (*a*) The enemy's position is on the general line Crows Nest—Fursdon—Merrymeet—Pengover Green—Trevartha.

(*b*) Our advanced troops are on the line Middlehill—Trebeigh Wood—Westdown Wood—Quethiock.

(2) The 3rd Division is to attack the enemy's position at 06.00 hours on August 18, 7th Infantry Brigade on the right, 9th Infantry Brigade on the left, dividing line main Liskeard road inclusive to 7th Infantry Brigade. First objective the line Newton—g in Tren*g*rove—v in Tre*v*artha, second objective St. Cleer—Liskeard inclusive. The attack is to leave the line of first objective at 07.30 hours. The 8th Infantry Brigade is to be in reserve at Kenson.

(3) At 06.00 hours field ambulances will be established as follows :—

(*a*) 7th and 8th Field Ambulances each less two companies will form a combined main dressing station under the senior ambulance commander at Newbridge.

(*b*) Two companies 7th Field Ambulance (each less stretcher-bearers and one officer) will be at Gang and form an advanced dressing station with

one company (less stretcher-bearers) keeping one company (less stretcher-bearers) in reserve. The stretcher-bearer parties of these two companies will be at Hay Barton. These companies will clear the area of 7th Infantry Brigade.

(*c*) Two companies of 8th Field Ambulance (each less stretcher-bearers and one officer) will be at St. Ive and form an advanced dressing station with one company (less stretcher-bearers), keeping one company (less stretcher-bearers) in reserve. The stretcher-bearer parties of these two companies will be at Point 547. These companies will clear the area of 9th Infantry Brigade.

(*d*) One company 9th Field Ambulance less stretcher-bearers under an officer, will form a divisional collecting station for walking wounded at Kenson, which will be cleared under arrangements of A.D.M.S.

(*e*) 9th Field Ambulance less collecting station party detailed in (*d*) will be in reserve at Newbridge, ready to march at half-an-hour's notice.

(*f*) Motor ambulance cars of 7th and 8th Field Ambulances will clear advanced dressing stations Gang and St. Ive to main dressing station Newbridge under the orders of officer commanding main dressing station.

(4) D.M.S. has been asked to commence clearing main dressing station Newbridge at 07.00 hours.

(5) As troops move to second objective advanced dressing stations farther forward will be formed by the companies (less stretcher-bearers) of 7th and 8th Field Ambulances in reserve (para. 3 (*b*) and (*c*)), and sites reported to A.D.M.S.

(6) Reports of numbers remaining in the main dressing station and divisional collecting station at 08.00, 12.00, 16.00 and 20.00 hours will be sent to A.D.M.S. at divisional headquarters, Kenson. The report at 08.00 hours will also state the numbers evacuated, subsequent reports will state the numbers evacuated since previous report.

(7) Acknowledge.

Issued at 18.30 hours.

(Sgd.) H. J., Major.
D.A.D.M.S., 3rd Division.

Issued to :—7th F. Amb.
8th F. Amb.
9th F. Amb.

Copies to :—"G."
"A." and "Q"
D.M.S.
File.
War Diary.

THE WIDAL TEST IN THE DIAGNOSIS OF PARATYPHOID B FEVER IN THE INOCULATED SUBJECT.

By Captain ALEXANDER HOOD.
Royal Army Medical Corps.

I have recently had the opportunity of investigating the agglutinin content of the serum in fifteen cases of paratyphoid B fever, of whom eleven had been inoculated with T.A.B. vaccine. The technique used was Dreyer's, and the results are expressed in agglutinin units per cubic centimetre of serum. All sera were examined at least three times, some four and a few five times, at intervals of about a week.

The diagnosis of paratyphoid B fever was made bacteriologically in five cases; the remainder presented similar clinical symptoms and were part of the same very limited outbreak. As will be seen the result of their Widal tests proved them also to be infected with *Bacillus paratyphosus* B.

TABLE I.—Inoculated Men. Serum examined during First Week of Disease. Seven Cases.

No. of case	Agglutinin units per c.c. against standard cultures: T	A	B	Day of disease	Inoculated	Remarks T.A.B.—
1	11	23	44	6th	2 doses	1 year previous
2	25	10	44	5th	2 ,,	1½ years ,,
3	27	5	40	7th	1 dose	1⅛ ,, ,,
4	4	11	40	7th	2 doses	½ year ,,
5	50	Trace	439	7th	2 ,,	3 years ,,
6	25	10	87	4th	2 ,,	1½ ,, ,,
7	25	10	439	7th	2 ,,	½ year ,,

From the above table it will be seen that even in the first week of the disease the Widal reaction pointed to a paratyphoid B infection.

TABLE II.—Results in the Uninoculated; Serum examined during the First Week. Two Cases examined.

No. of case	Agglutinin units per c.c. against standard cultures: T	A	B	Day of disease
8	0	0	60	6th
13	0	0	87	5th

TABLE III.—Results in the Inoculated during Second Week of Disease. Three Cases examined.

No. of case	Agglutinin units per c.c. against standard cultures: T	A	B	Day of disease
2	25	27	440	14th
6	100	5	8,700	14th
14	5	5	880	10th

These figures definitely point to a paratyphoid B infection.

Note the comparatively high content of No. 6 against *B. typhosus*.

Lieutenant-Colonel Perry, in commenting on this well-known phenomenon, states:—[1]

[1] *Lancet*, April 27, 1918.

"It has been suggested that in addition to producing its homologous agglutinins, a paratyphoid A or a paratyphoid B *infection* is also capable of elaborating agglutinins for *B. typhosus*. Experience of these *infections* in the non-inoculated has disproved this view. The agglutinins produced have been strictly specific, and there has been no appearance of agglutinins other than those corresponding to the *infecting* organism. The rise in titre of the typhoid inoculation agglutinins has not been a non-specific production, but a stimulation of the mechanism which has already been established by the typhoid inoculation. It is quite conceivable that infection with a closely allied organism will cause such re-stimulation."

TABLE IV.—Results in the Uninoculated during Second Week of Disease. Three Cases examined.

No. of case	Agglutinin units per c.c. against standard cultures: T	A	B	Day of disease
11	0	0	400	10th
12	0	0	88	10th
13	0	0	1,316	13th

These cases and the cases in Table III are comparable.

It will be seen that there are no agglutinins for T or A present in the uninoculated.

TABLE V.—Results in the Third Week of Disease in the Inoculated. Six Cases examined.

No. of case	Agglutinin units per c.c. against standard cultures: T	A	B	Day of disease
1	12·5	27	880	15th
3	25	20	440	16th
4	5	27	3,500	15th
9	25	40	7,000	18th
15	50	19	880	17th
7	25	48	4,400	15th

TABLE VI.—Results in the Third Week of Disease in the Uninoculated. Two Cases examined.

No. of case	Agglutinin units per c.c. against standard cultures: T	A	B	Day of disease
11	25	0	8,700	19th
12	50	0	1,760	19th

These tables show that a small amount of coagglutinins for *B. typhosus* have appeared in these two uninoculated cases during the third week of *B. paratyphosus* B infection. No coagglutinins for *B. paratyphosus* A were found at any time in the uninoculated.

The coagglutinins against *B. typhosus* were present in equal amounts in inoculated and uninoculated cases by the third week of disease.

The serum of eight inoculated men suffering from other febrile diseases was examined, and in no case did the paratyphoid B agglutinin content exceed ninety units per cubic centimetre (one case only approached this amount, the remaining seven being under fifty units per cubic centimetre), although all had been fully inoculated within the year.

A second examination was made in these cases after one week interval, and none of them showed any appreciable rise in agglutinin content.

The answer to the question: "Can a diagnosis of paratyphoid B fever be made from a single Widal result in inoculated subjects? is to be found in a paper by Lieutenant-Colonel Perry, who discusses the matter as follows:—[1]

"Admittedly, a single estimation of agglutination titre, by whatever method determined, is of no value in the diagnosis of these cases. A table[2] is appended which shows the variation in titre observed in twenty consecutive cases admitted to hospital with pyrexia as 'suspect enterics,' but which, on examination, were negative both clinically and bacteriologically as regards an enteric group infection.

"It is evident that the variability in agglutinin content in these cases is dependent on several factors: (1) The length of time that has elapsed since the administration of the vaccine. (2) The dose of the vaccine given. (3) The value of the vaccine as an antigen. (4) *The individual response in the production of antibody which must necessarily be variable.*"

A study of the curves obtained in these fifteen cases by charting the results of three or more successive examinations at intervals of about a week showed in both inoculated and uninoculated that they were very similar.

The highest point in the curves was between the fourteenth and twenty-first days, the rise more rapid than the fall.

The rise was not steeper in the inoculated in this series of cases, but the fall in the inoculated was more gradual.

The practical conclusion is that, failing a positive blood culture, three Widals at intervals of four days offer a reliable method of diagnosis even in the inoculated subject.

In every one of the cases in this series the second Widal was suggestive apart from other bacteriological findings.

It is important that the serum should be obtained as early as possible in the disease, that is, when blood culture is being done immediately an enteric infection is suspected.

This early Widal gives a base line of agglutinins in the inoculated subject, and a sharp rise in the following week is to be expected in cases of *B. paratyphosus* B infection, and probably in other members of the group; of course the routine examination of the excreta is proceeded with.

While the number of cases is small, they seem to show that the Widal test is of undoubted value in the diagnosis of paratyphoid B fever in the inoculated subject.

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Ainley Walker. *Lancet*, November 25, 1916.
Dreyer, G. *Ibid.*, March 10, 1917.
Glynn and Cronin Lowe. Journal of the Royal Army Medical Corps, December, 1916.

[1] Marrian Perry: *Lancet*, April 27, 1918.
[2] This table is in the paper referred to, and is too long to include in this article.

Clinical and other Notes.

A CASE OF PARATYPHOID FEVER TREATED WITH A VACCINE WITH A NOTE ON THE AGGLUTININ CONTENT OF THE BLOOD.

By Major ALEXANDER HOOD.
Royal Army Medical Corps.

AND

Captain J. B. WILLIAMSON.
Royal Army Medical Corps.

Signaller J. was admitted to No. 3 General Hospital, Langenfeld, on May 25, 1923, as a transfer from 36 Casualty Clearing Station, Cologne, convalescent from an acute attack of tonsillitis. This had cleared up on arrival, but for the first four days the patient had an evening temperature of 99° F. This was proved on investigation to be due to a tubercular lesion at the apex of the right lung. No bacilli were found, but the sputum was blood-tinged daily.

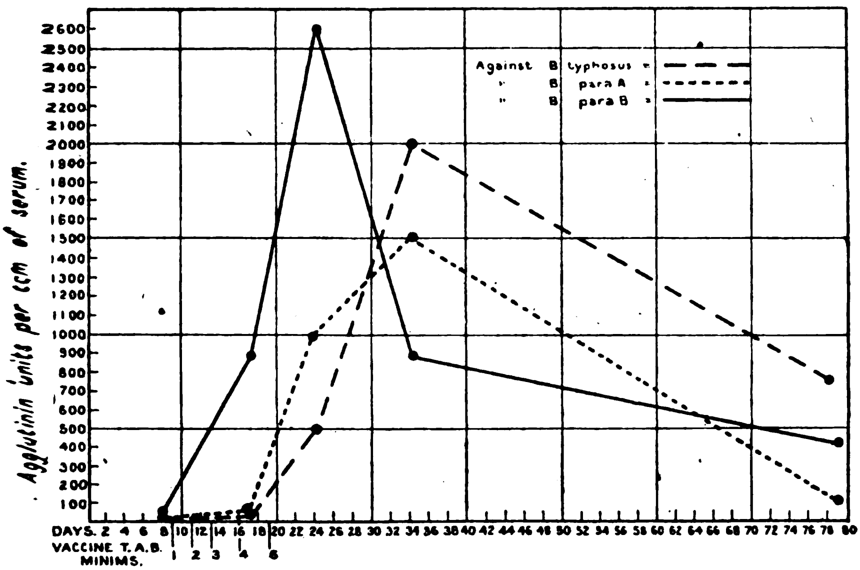
On May 30, 1923, the patient's condition underwent a rapid change. The evening temperature rose to 101° F. with a pulse of 98; there was a well-marked rigor and complaint of general headache. By the next evening the temperature had reached 103° F., and the pulse was 84. The patient was flushed and hot, but otherwise there were no physical signs. The temperature remained for the next five days at a varying level from 101° F. to 103° F. There were no signs or symptoms pointing to the nature of the fever. A leucocyte count of a total value of 6,000, with a differential count of 46 per cent polymorphs against 52 per cent lymphocytes (both varieties), and hyalines 2 per cent was of negative value in excluding all conditions associated with a polymorph increase, but was compatible with the tubercular lesion *per se*.

The next day—the eighth of the disease—blood was withdrawn for culture. At the same time Marris's atropine test gave a positive result—the reading of the pulse half an hour after an injection of $\frac{1}{33}$-grain atropine sulphate being 80 compared with 70 before. This was a helpful confirmatory point in arriving at a diagnosis of enteric-group infection. However, the same evening large rose spots appeared, and the next morning a typical enteric smell was obvious. The patient's general condition by now was far from satisfactory, meteorism was present as evidenced by an enlarged and tender abdomen, the patient was listless and apathetic, sordes tended to accumulate in the mouth; the pulse, though regular and slow, was weak and compressible, so that the clinical picture

was one of severe toxæmia. Vaccine treatment was instituted at this stage.

In the absence of knowledge of the exact nature of the infection, stock T.A.B. vaccine was employed, one minim, corresponding to 55 millions of *Bacillus typhosus*, 42 millions of *B. paratyphosus* A, and 42 millions *B. paratyphosus* B being the unit employed.

The first injection of one minim was given on June 7, 1923, being the ninth day of disease. The injection was followed by a severe local reaction and a general reaction manifested by an extra rise of temperature of one degree; no marked change occurred. On the eleventh day two minims were injected, a severe local reaction occurred again, but the interesting thing is, that the temperature now developed a remittent swinging



character with a lessening range each day. The fact that this occurred as early as the eleventh day of the disease may have been a coincidence, but, taken in conjunction with the rapid amelioration in the general condition, it seems very probable that the vaccine played a large part in the unexpected improvement in the clinical manifestations. A third injection of 3 minims was given on the thirteenth day, 4 minims on the sixteenth day, and 6 minims on the nineteenth day of disease. The course of the disease was nineteen days, excluding a small rise, really due to the last vaccine injection. The disease cannot be considered to be shortened, but just as it can be claimed that the absence of complications, the modified course of the fever, and the early onset of lysis, may be due to vaccine therapy, much more so can the absence of any extension of the tubercular lesion be considered to be very definitely due to the vaccine.

Paratyphoid B is one of the most serious accompaniments of pulmonary tuberculosis. One might readily have expected a slow chronic process to have developed into an acute febrile condition. Far from progressing downhill after the acute illness, the patient made a surprisingly good convalescence, and, except for an occasional evening rise to 99° F., looks and feels well, and has put on weight.

The *B. paratyphosus* B was never isolated from the case, blood culture on the eighth day being negative; fæces and urine were cultured many times, both during the disease and in convalescence, but no organism of the enteric group was isolated. The diagnosis of paratyphoid B fever was made on the following grounds:—

(1) The case was one of a small group of similar cases exposed to a short-lived infection from several of whom the *B. paratyphosus* B was isolated.

(2) The second Widal test points to the same infection (see chart).

(3) The clinical symptoms and physical signs were similar to the other cases mentioned under (1) above.

The results of the Widal tests were interesting, and are shown in the chart attached; Dreyer's technique was employed, and the results expressed in agglutinin units per cubic centimetre of serum. These tests were done against *B. typhosus*, *B. paratyphosus* A, and *B. paratyphosus* B, on the eighth, seventeenth, twenty-fourth, thirty-fourth, and seventy-ninth days after the commencement of the disease. On looking at the chart, it will be seen that on the seventeenth day when the second Widal was done, the agglutinins against *B. paratyphosus* B had reached the high figure of 880, whilst those against *B. typhosus* and *B. paratyphosus* A were under 100. He had been inoculated with T.A.B. vaccine (two doses) three years previously. Stock T.A.B. vaccine was given as indicated above, so that by the eighteenth day 16 minims equal to 880 millions *B. typhosus*, and 670 millions each of *B. paratyphosus* A and *B. paratyphosus* B. Six days after the last injection the Widal test was done again (twenty-fourth day of disease); by that time the effect of the vaccine was well marked, agglutinins for T. and A. had risen to 2,000 and 1,500 respectively, while those for B. were 2,600 units. The fourth Widal, on the thirty-fourth day of disease, showed a further rise in T. and A. agglutinins and a sharp fall in B. agglutinins, the patient now being convalescent. Compared with the Widal curves of fourteen other patients not treated by vaccine, it cannot be said that this patient showed any marked difference in his agglutinin curve against *B. paratyphosus* B—the rise was no more rapid, the height no greater, and the maintenance no longer, being only slightly above average in these respects. That his agglutinin production would have been so marked without the vaccine is a matter for speculation, but, as his response to the T. and A. part of the vaccine was so good, we conclude that the B. response was similar. It will be noted that the development of T. and A. agglutinins due to the vaccine was not seen on the seventeenth day, by

which time the patient had received ten minims of vaccine; one week later they had reached a high figure. This indicates the development of agglutinins due to the treatment as distinct from the disease, and if the agglutinin curve is an indication of developed immunity, it follows that to be of the greatest value vaccine treatment must be started early preferably by the fifth day of disease. By the seventy-ninth day it is interesting to note that there were more agglutinins present for *B. typhosus* produced by the vaccine than for *B. paratyphosus* B produced by both vaccine and disease.

Conclusions.

While we recognize that conclusions based on one case are fallacious [1], at the same time they are worth recording, and this case brings the following points out:—

(1) The clinical improvement following the administration of the vaccine was well marked.

(2) A case dangerously complicated by the presence of pulmonary tuberculosis, and which, to begin with, promised to be severe, ran an average course under vaccine treatment.

(3) Agglutinin production against *B. typhosus* and *B. paratyphosus* A, due to the vaccine, began between the eighth and the fifteenth day after the first dose; when it began for *B. paratyphosus* B is doubtful, but as the body had already commenced the process, the vaccine probably stimulated this production earlier.

(4) The relative positions of the agglutinin curves on the seventy-ninth day after the disease commenced, T. being highest, A. lowest, and B. intermediate.

Editor's Note.

Lieutenant-Colonel Perry, R.A.M.C., Professor of Pathology Royal Army Medical College, to whom we referred this paper, has made the following criticisms:—

"It is obvious that observations based on the experience of one case must be fallacious. This is emphasized in the paper by Whittington [1] on the use of stock vaccines employed in 230 cases of typhoid infection. His conclusions are: (*a*) That the vaccine, used therapeutically, neither shortened the fever nor reduced the number of complications. (*b*) That there was some indication that the vaccine increased the incidence of hæmorrhage. He adds: 'that these conclusions are contrary to the impressions I had received during the treatment of the earlier cases. I had not then seen a sufficient number of similar cases which did well without vaccine, and, being rather biased in favour, I gave undeserved credit to this treatment.'"

On the other hand, MacArthur publishes three cases [2] which were treated by vaccine and which impressed him favourably. These cases were inoculated during the incubation period of the disease.

It is probable that these divergent observations would be brought into line if the period of the disease at which vaccine treatment was initiated was taken into consideration. It is obvious that in the developed disease vaccine treatment can be of little avail, whereas in the very early period favourable results are likely to follow its administration."

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[1] Whittington. Journal of the Royal Army Medical Corps, 1916, xxvii, p. 422.
[2] MacArthur, W. P. *Ibid*, 1914, xxii, p. 695.
[3] *Idem.* *Brit. Med. Journ.*, 1914, ii, p. 175.

CLINICAL NOTES ON A CASE OF FRACTURED PELVIS COMPLICATED BY EXTRA-PERITONEAL RUPTURE OF BLADDER.

By Captain MANFRED MORRIS,

Royal Army Medical Corps.

Surgical Specialist, Colchester.

The routine of the surgical specialist is so rarely disturbed during the summer months by problems arising from severe traumatic conditions that it is hoped these few notes may be found of interest.

A civil subordinate, aged 43, attached to the R.E. Works Department, whilst at work was struck down by a wooden platform on which were lying several bags of cement. The platform was suspended from the end of a travelling crane by chains, one of which snapped and so caused the accident.

The patient stated "he was crushed in or near the middle," but was naturally unable to give much detail of the accident. He was given first aid locally, and his notes stated: "He has sustained a compound fracture of the nasal bones and scalp wounds necessitating seventeen sutures. He is unable to pass water and a catheter draws off blood-stained urine. He has severe contusions of the right hip and the left shoulder."

I do not propose to refer again to the injuries of the head and shoulder, but will confine myself to a description of the abdominal condition.

My attention was drawn to this case five hours after the injury had been received and after the patient had completed a journey of some hours in an ambulance. He was then suffering from profound shock, was cold, pulse 120 and temperature sub-normal. The man was perfectly conscious, and complained of agonizing pain in the abdomen, situated chiefly in the hypogastrium. The pain was described as of a stabbing, rather than of a colicky nature. He had not vomited and had passed flatus. The facies was that of a severe hæmorrhage case, the mucous membranes being very anæmic. The abdomen moved very little on respiration. There was a mass the size of a large orange with indefinite edges in the left Poupart and iliac regions. This was semi-solid and equisitely tender. The

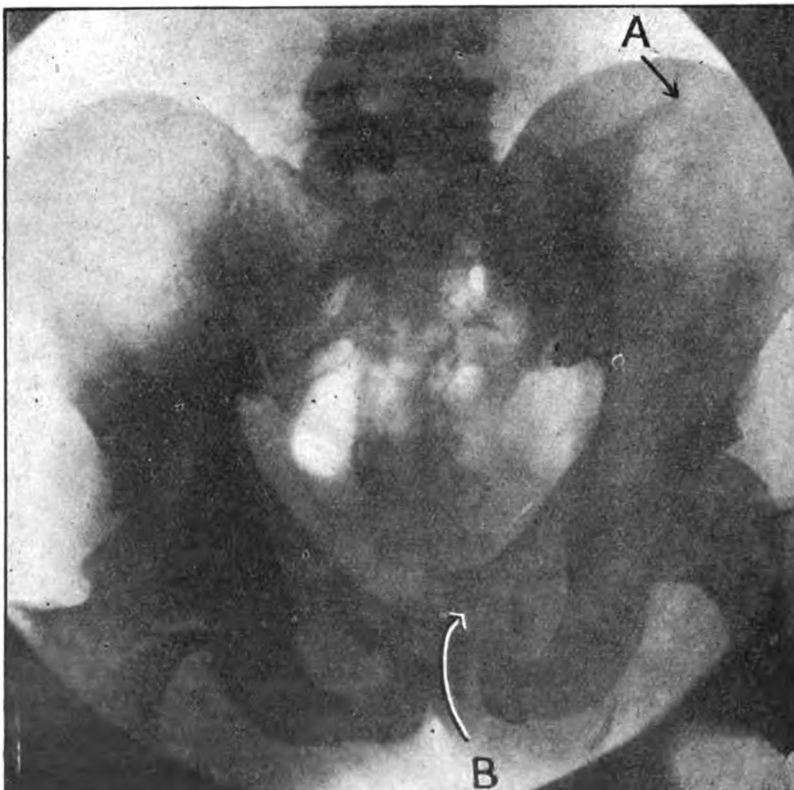
abdomen was as rigid as a board and one could not eliminate the resistance by flexing the knees or altering the patient's posture. Shifting dullness in the flanks was not elicited. Lateral pressure on the crests of the ilia was painful and also any movement of the lower limbs. Rectal examination revealed great tenderness in front of the trigone area. Passage of a Jacques catheter, which was easy and painless, caused a few ounces of bloody urine to be withdrawn. From the above history and physical signs I decided that the patient had fractured his pelvis and had probably an intra-peritoneal lesion of his bladder, causing peritoneal irritation. It was obvious that abdominal section was necessary, and I gave $\frac{1}{6}$ grain morphine hydrochlor. hypodermically and waited an hour while he was warmed up and the theatre prepared. The patient's limbs having been well bandaged in cotton wool and his thorax enveloped in a gamgee jacket he was removed to the theatre. A final abdominal palpation just before he went under his anæsthetic showed the abdomen to be still generally rigid. Major O. C. P. Cooke anæsthetized and gave A.C.E. on a Yeo's mask, assisted by Captain J. E. Foley I opened the abdomen in the middle line. After a careful and systematic search I failed to find any pathological lesion or change in the peritoneal cavity. We therefore closed the peritoneum and dragged the bare area of the bladder into the lower end of the wound and anchored it there with two silk ligatures. The large hæmatoma dissecting up the abdominal wall was then cleared away. Palpation in the cave of Retzius and retraction of the recti muscles showed a fracture of the pubic arch half an inch lateral to the symphysis. On the left side the ends of the pubis were overriding and irreplaceable. The bladder was then opened. A little blood and urine escaped. Visual examination of the bladder in the absence of suitable retractors, headlight, etc., was impossible, but there appeared to be a perforation of the bladder at its base anterior and superior to the trigone. The patient's condition was now critical, and I completed the suprapubic cystotomy by closing the wound round a large tube in the bladder, and draining the cave of Retzius. The wound was dressed with a solution of bismuth and sterile paraffin and a McDougal's apparatus applied, draining into a bottle below the bed. His condition for twelve hours was grave, but anti-shock treatment prevailed and he made an uneventful recovery. He was nursed on his back, lying between large sand bags placed against his hips. The abdomen and suprapubic sinus were soundly healed in four weeks, and nine weeks after the operation the patient passed normal urine with no trouble or pain, and can hold it all night with ease. Ten weeks after the accident I allowed him to get about on crutches, and now he can stand up without any support or pain and is just commencing to walk.

Radiograms were taken six weeks after operation here, and I add copies of the report on the film and reduction of the negative from Major D. B. McGrigor at Millbank to whom I sent the original as an unusual case.

The film shows extensive double fracture of pelvis.

A, Fracture of left ileum middle of crest obliquely down and back to the middle of the sacro-iliac synchrondrosis. I do not think there is much displacement although this is difficult to decide without stereoscopic work.

B, Fracture dislocation of the left pubis with comminution over crest and under spine and involving angle and symphysis of pubis, the lower ramus impacted into ischio-pubic ramus.



Further I think the radiogram of the pelvis of an exceptional high technical standard, and it is most interesting to note that the radiographer produced this excellent film of a very difficult case with an ordinary field service outfit, using: Milliamperes, 5; spark gap, 6 inches; exposure, 10 seconds; position, A.P.; cathode distance, 24 inches; duplitized films and double intensifying screens.

In conclusion I would lay stress on the following points :—

(1) The importance of immediately passing a catheter in cases of severe injury to the lower abdomen and pelvis.

(2) It is my invariable custom in these cases to instruct them, however

urgent the desire, to refrain from attempting to urinate until catheterization has excluded vesical or urethral trauma.

(3) The length of time so-called "peritonism" can last.

In this case the peritoneal reflex causing abdominal rigidity lasted six hours after the accident in spite of morphia, and although there was apparently no definite continued peritoneal irritation after the initial blow on the abdominal wall.

(4) I would, in spite of this, explore the abdomen in all cases with similar physical signs. A negative result is not to be compared in danger to delay in performing laparotomy in cases of perforated hollow viscera.

I must thank Colonel L. Humphry, C.M.G., R.A.M.C., my commanding officer, for permission to publish this case and for his encouragement and help.

Sport.

HINTS ON FISHING IN THE NILGIRIS.

By TOTEM.

Many a keen fisherman, who has brought his rod and tackle to India on the chance of enjoying his favourite pursuit, finds himself possessed of a few weeks leave in the Nilgiris, and sets off to test the trout-stocked streams; but is handicapped by lack of local knowledge and shortness of time in which to remedy that defect.

These rough notes may be a help to such enthusiasts although the resident angler may well glance at them with tolerant scorn.

The notes will describe briefly all the fishing localities; the methods of approach, and the various methods of fishing which the writer has successfully employed will be discussed.

The fishing localities consist of a series of rivers, the majority of which have been stocked with trout of the rainbow variety, and are preserved. Details as to preserved areas and licences may be obtained from the District Forest Officer, Ootacamund. Season, monthly, and daily licences may be obtained for the specially preserved streams and also for the streams which are open all the year round.

The enthusiastic fisherman who cannot obtain leave during the open seasons for the special streams, should note that excellent sport may be had in the latter in the off months, i.e., November to April for a daily licence of Rs. 2 only.

I.

The Avalanche and Emerald valley streams flow east from the Kundahs and join to form the Kundah river which flows down a deep gorge to join the Bhavani. The two former are open during the season only: the latter is open all the year.

The Kundah river is open for about one mile below the junction and from Kundah bridge downwards. There is no earthly reason why the intermediate part should not be opened too. This water consists of large rocky deep pools with some excellent fish. There should be monsters in some of the pools, but they appear to be too exclusive; however by using either spoon or worm a bag of eight to ten decent fish should reward a day here. A trout of over three pounds recently rewarded one effort at Kundah bridge.

This bridge portion may be reached by car by the road from Coonoor, up the Kateri valley, and past the shoulder of Devashola. The pools are difficult of access and to reach them requires considerable gymnastic ability. Beware of floods from sudden storms as the river here can rise four feet in ten minutes.

The upper portion should be reached by taking the Ooty—Avalanche road and bearing to the left at the signpost six and a half miles out. A car can be taken as far as a flat grass plot overlooking the Avalanche valley and only half a mile from the junction.

* * * * *

The Avalanche is the best stocked stream, but the size of fish has sadly fallen off. The five-pound monsters of a few years ago depicted on the walls of the Avalanche Bungalow seem to have gone the way of all things and are now conspicuous by their absence.

The lower part from the junction should be reached in the same way as the upper Kundah. At the junction there is fine deep water where dry fly may be used successfully. After this comes a series of rocky pools for a mile or so, with two large gravelly pools which have some good fish but which are persistently flogged by every fisherman. A wet fly is probably the best here.

Above this is a long flat water, showing current whirls here and there, which make very effective dry fly spots and hold good fish. Then a series of rocky pools culminate in a small fall; there are some good fish here.

Above this is a series of beautiful long flat gravelly pools up to a high banked S bend. Here either a wet or a dry fly will give good sport; but the fishing must be fine and far off.

The next mile or so consists of excellent gravel pools with a couple of long flat pools: and here we reach the Ooty—Avalanche road which crosses the river by a ford on its way to the Avalanche Bungalow.

Above the road is a similar type of water, easily fished; but with the fish becoming distinctly smaller until the junction of a tributary stream, near a waterfall, is reached: above this the size of fish diminishes considerably.

The would-be angler can stay for a few days at the Avalanche Bungalow (permission from the D. F. O., Ooty) and should visit the trout hatchery which, although small, is worth seeing. This part of the river should be reached by the Ooty—Avalanche road; five miles from the finger-post.

It is not a joy ride for motors, but is passable. If you go by car have rope or chains for the back wheels; if by motor cycle combination a twelve-yard length of rope is useful for haulage. If heavy rain comes on these hills become appallingly greasy.

Do not start near the road where the fish are as sophisticated as a Bibery or Fairford trout or as the three Grayling of Dovedale.

The best parts of the river are the middle reaches. Those who want an average bag of 6—8 ten- to twelve-inch fish should stick to the lower end; those who prefer to land from 30—40, of which 8—10 are sizable, should go to the upper reaches.

The Emerald valley stream.—From the Junction, for about a mile up, there is a series of broken pools which have some goodish fish, but you should search the odd corners with your fly for these. This bit culminates in a small fall above a smooth sweep of rock.

Above this is some flat open water with some good pools; all of which give excellent results with a dry fly.

Then a series of rocky runs surrounded by bushes leads to a long piece of fairly sluggish smoothly flowing water. This gives the best fishing, and is the best dry-fly strip, and great fun may be had with a small dry fly and fine tackle.

A rocky piece of half a mile brings us to the black bridge where the Ooty—Avalanche road crosses the stream.

Above this is a long flat water; then four good pools where the stream comes through the hills. Beyond is a broad open valley with good gravel pools in succession up to where the stream becomes too small with a large tributary coming into it. Up here the fish are on the small side, but the fishing is interesting if a small fly and fine casts are used.

The best bit of water is again the middle piece.

Do not merely go to the black bridge and fish from there. That is the fate of all temporary visitors who lack local knowledge.

II.

The Bilitadahalla stream flows south from the Kundahs to form the Bhavani River. A five mile walk or ride over the hills from the Avalanche Bungalow will bring the enthusiast there. There is fine water and plenty of fish; but the magnificent fish of years ago are apparently gone, and only small fellows are now obtainable. The scenery is magnificent, but it is a somewhat strenuous undertaking for the day unless the start is made from the Avalanche Bungalow.

Do not waste time investigating the Coonoor or Kateri or Kallar streams as there is nothing worth looking at, even low down. The Kateri lakes are shortly to be stocked with trout, I understand. The angler who is fortunate enough to have the chance during the first two years in which these are opened to fishing should catch some heavy fish.

Do not waste time fishing the Ooty lake unless you have a penchant

for very small English carp, and care to compete with the local fishermen for the honour of catching four- to six-inch sprats. It is a pity that this water was not stocked with something better. A few good English pike would be a blessing.

Above Ooty on the Dodabetta slopes are the Ooty Reservoirs. A few trout have been let loose here but their presence is somewhat uncertain now. A friend several years ago got two of nearly four pounds each in one reservoir; so that it might be worth while having a try after obtaining permission.

The Bhavani River which flows past Metupalayam and which is crossed in the train is a fine looking river. Do not be deceived by this part. Much poaching of every description has left it bare; and days spent on miles of this part have yielded nothing to spoon, worm, fly or minnow. Netting and conical-paddy field traps have been too effective for breeding fish and small fry.

It is in the upper reaches in the jungles where the fine mahseer fishing lies. This part may be reached from Metupalayam by bridle path; or by bridle path down the ghat from Kolakumbai which can be reached by car from Coonoor. Regular camping arrangements for at least ten days should be made. The best sites are above Sundapathi and coracles and boatmen are necessary. The intending mahseer-hunter can get these from Metupalayam where Thomas' original boatman is said to be still alive. The quality and quantity of fish seem to have fallen off sadly since the halcyon days of which Thomas wrote. However, strong tackle and plenty of spares are advisable.

* * * * *

The Moyar runs in the Mysore ditch amidst dense jungle to join the Bhavani eastwards of the Nilgiris. The lower reaches are very ungetatable except on a shooting trip, but apparently do hold some very big fish. Also a fine selection of anopheline malaria-carriers may be met with.

The middle reaches may be approached during a shooting trip to Mahsinigudi. Beware of venturing lightly down the Sigur Ghat to reach Mahsinigudi. A forty-pounder is said to have been taken here not long ago.

From Tepakadu towards Gudalore the Moyar accompanies the Mysore road for some five miles and shows some perfect looking mahseer water to the expectant angler. Alas! the poacher or some other friend has removed all the decent fish and many days' trial has produced nothing more than two or three two-pound carp. So do not let your fisherman's heart rejoice in the sight of this water on your trip from Mysore: it is not now worth a trial. The gamewatchers here, as elsewhere, on all the streams, are entirely absent and the ten- and fifteen-pounders of a few years ago have also vanished.

* * * * *

The Pykara, which below the Pykara Falls becomes the Moyar, is a large stream with big open pools with some broken water, with a reasonable stock of trout and a large growth of Malabar carp. It is easily reached as the Mysore road crosses it at the twelfth milestone by the Pykara Bridge and the rest bungalow is only a few yards off.

About a mile below the bridge is a series of pools and falls well filled with trout which may be beguiled by fly, spoon or worm.

From this upwards to the entrance of the Yemmakal stream on the north bank is a series of long, open large pools. The pools near the bridge hold few trout as they are perpetually flogged by every would-be-catcher of fish who visits this spot. The Malabar carp however abound and are fine fighters. Secure the assistance of the gamewatcher at the Bungalow for a supply of frogs or beetles and you should have some exciting times with two- to four-pound carp.

All months of the year some enjoyable days are available here for those who try.

From the Yemmakal stream up to the junction of the Mukerti and Krurmund is also open all the year and we have had delightful days of a rambling type of fishing over this part, even in March. The fishing is not easy but quite good enough for those who really try it.

To get there, stop at Windy Gap or the eighth milestone on the Mysore road and walk down the Yemmakal Valley about 2½ miles to the main stream. The Yemmakal is stocked as a feeder but fishing in it is not allowed. If you cover the whole fishing distance this will give you a good sixteen to eighteen-mile walk but there are some fine pools to compensate for it. All places where there are rocks showing or the smallest whirl of current are the spots to try for trout, and great shoals of carp are met with elsewhere.

A small black fly on a fine cast or a small red-worm used like a fly will give excellent fun, and the keen fisherman who cannot get leave except in off-seasons will find, if he tries this type of fishing, that life is still worth living.

* * * * *

The Krurmund.—This is a rocky stream with some good fish and consists chiefly of large rocky pools with one long stretch of flat water above some high falls. The best pools are below the falls, whereas the flat water is good with a strong ripple. Eight to ten good sized trout may reasonably be expected here in a day's fishing. The long flat water lies from half a mile below the Krurmund Hut to the Parsons Valley stream which is closed to all fishing. Above the hut is a series of rocky pools but the fish are distinctly smaller.

III.

The Mukerti.—This is probably the best of all the streams. From the junction upwards are a number of fine large rocky pools. Above this is a three mile stretch of flat winding river, very deep in parts with high

banks and some good weed patches. This nowadays probably holds some of the best fish, and can be fished with a dry fly but with a heavy ripple often present a well sunk wet fly is probably the best: above comes some perfect dry fly water which gives excellent opportunities of carrying out this method, but unfortunately the fish are on the small size as the river rapidly diminishes and the feed is evidently poor.

These two streams are reached by the bridle-path which goes from Governor's Shola to Mukerti Peak. There is a hut on the Krurmund where two can stay or the day-trip can be easily made. A car can go half a mile beyond Governor Shola or a Ford can go three miles farther on. From the former spot a walk of an hour and a half or riding on "Tats" will bring the fisherman to the Krurmund hut. The Parsons Valley stream is crossed on the way. The Mukerti is three miles farther on by the bridle-path which crosses it at the upper end of the flat water, or the angler may strike down the Krurmund to the top of the flat water of this stream and cross the hills in a south-westerly direction. This will give access to the lower end of the flat water of the Mukerti.

Those with only a few weeks' leave should make certain of trying these streams.

Methods of Fishing.

Flies.—These naturally are much debated, and every resident angler has his own pets. In the stocked streams fly only may be used, and we would suggest the following six as being the best in the order given. Of course many others are effective at times, but these are the ones we stick to and have landed more than 350 fish in a month with them: (1) Black Palmer or, as a variety of this, the Zulu or Killer, (2) Hardy's Black and Silver, (3) March Brown, (4) Wickham's Fancy, (5) Greenwell's Glory, (6) Pale Olive Dun.

Numbers (2), (5) and (6) are also good as dry flies, though for this method we always use a Hardy's "Tupps Indispensable" which represents the Dun family. The pale Olive Dun, or something suspiciously like it, is a fly we have frequently seen on the long quiet stretches of the Avalanche, Krurmund and Emerald Valley. The size of fly varies with stream. No. II Limeric is about the best size for tail flies and smaller for droppers. The local purveyors of fishing tackle in the Madras Presidency almost invariably sell flies of too large a size. Use larger flies for the Avalanche and Mukerti than for the Emerald Valley and Krurmund. When the streams are full, use a large Black Palmer, Chubb size; this is often effective, sunk deep in the quiet backwaters of large pools. We tie a rather scanty, bristly-hackle Black Palmer on an oversized hook, as this gives good sinking qualities and a lively action in the water.

For the Pykara in the bright dry winter months a small black fly or a bright glistening "Wickham's Fancy" will give good results.

The use of the dry fly appears to be regarded with scorn by many resident anglers. The writer employs it on every possible occasion and

finds that this method yields the best fish and eliminates the catching of dozens of small ones. There are stretches on each stream which are suitable, and the fun is infinitely greater. Of course, there are days of wind and rain when it is ridiculous to attempt this method; but on the warm sunny days of August and September it is always worth a trial. This method does not necessarily mean sitting waiting for a rise as on Southern English waters. All likely spots round stones, below bushes or opposite holes in high banks where the wet fly would be useless should be searched by the floating fly. Many a time, when the wet fly has proved ineffectual, the floating fly has drawn a brown streak from some suitable spot and then disappeared with that pleasant plop into the mouth of some astonished sizable fish.

Casts.—Remember the water is often clear as gin and fine casts with long casting will give you the best results. Tapered casts with four feet of 1X gut are satisfactory; but the carp of the Pykara are apt to test this pretty severely. The local firms appear to imagine that one is fishing for whales, not trout.

* * * * * *

Some people prefer to work up-stream and to cast up-stream and others the reverse, but whether working up-stream or down we find that to cast down and work the fly against the current always produces the most fish. Often a good fish will lie right up in the very top of the stickle even right under the white water and no amount of casting from below will beguile him; whereas as a fly fished from up-stream which looks as though it is struggling against the current will almost always attract his notice.

Search all the spots behind rocks or round tree stumps or bushes, all deep black eddies and all holes in steep cat banks. It is surprising how often the brown flash of a sizable fish will reward you even after some less careful brother angler has abandoned the pool as being useless.

The best times of the day for fishing vary largely with the month. In the early monsoon, when there is rain and heavy wind and lack of sunshine, the middle parts of the day are usually best and after 4 p.m. useless, but we have seen a copious rise to natural fly as late as 6.30 p.m. In the brighter days of August and September from 9 a.m. to noon and 3.30 p.m. to dusk are the times for rising fish. It is curious how complete and sudden a lull occurs exactly at noon each day; this lasts completely for an hour, and then individual trout appear to rouse themselves once more until 4 p.m. brings on a full rise.

In the hot dry months on the Pykara early morning and late afternoon are the best.

IV.

Worm and Spoon Fishing.—These may be tried in the Kundah and Pykara. The former hardly needs describing, and the merest tyro can catch fish in the Kundah in this way. We find a worm on a single hook

without weights is best if cast gently up-stream and carefully worked through all the eddies. A small red worm cast on fine gut is a good sporting way in the low, bright water of March on the Upper Pykara.

A light fly spoon spun in the stickies of the Pykara may give a pleasant surprise at any moment.

The size of fish appears to have sadly fallen off, although breeding in the streams themselves is undoubtedly taking place. Gone are the wonderful seven- and five-pounders of early years. There may be a few, a very few, three-pounders hidden away, but we beg leave to doubt the gentleman who has a bungalow on the river, and who has seen numbers of five-pounders rising just below his house. The Mukerti produces the best size now, but the Avalanche can be quite generous. A day's fishing in the Avalanche a few days ago showed the following sizes in inches: 12, 11, 9, 12, 8, 11, 7, 10, 10, 9, 11, 15, 10, 11, giving a day's bag of ten sizable fish. This may seem absurd to those who knew the 16-inch limit, but it gives an idea of the present size of fish.

The size limit has now been removed; we consider this a mistake. We suggest that a size limit should be reimposed and strictly enforced; that this limit should be made to suit the stream, i.e., fourteen inches in the lower parts of the Avalanche, Mukerti and Kundah, twelve inches in the Middle Avalanche, Mukerti, Emerald Valley, Krurmund and Pykara, and no limit to numbers or size in the upper parts of the Avalanche, Emerald Valley and Krurmund; and that certain portions of each stream should be closed completely for a space of two years. If alternating portions were closed each year this could easily be managed.

* * * * * *

Coolies and Gamewatchers.—The latter are supposed to patrol the streams. They are now conspicuous by their absence, except at the respective huts. The watcher at Pykara is the only one who knows anything about the fish and can help with information. If the visitor wishes to see carp he can always demonstrate their presence by throwing in cowdung from the bridge.

If you wish to have your net and baggage carried, coolies are always available and only too willing to oblige for a consideration. The day's wage for a coolie for a day's *work* in these parts is As. 6. Why perpetuate the bad habit of presenting your coolie with R. 1 for loafing all day behind you with your landing net? As. 8 should be ample for such services as breaking your casts and losing your best fish.

We trust, if the editor is kind, and these notes ever reach the light of publicity, that they will benefit other enthusiasts who, like the writer, always carry their fishing tackle with them, and only have limited periods of time to pursue the noble art. The satisfied fisherman who examines his day's bag with a pleased eye should remember in thankfulness those who by an expenditure of much trouble and labour and no small sums of

money have made this fisherman's paradise a reality. Amongst those enthusiasts should be remembered the names of Mr. Marsh, Major Grant, V.C., Major Bagnall and Fish Wilson. Most delightful days can be spent on these rivers where one may well imagine the country to be Dartmoor or Wales, and a foreknowledge of details, such as the above, may materially add to the results thereof.

Current Literature.

The Statics of the Human Arch when subjected to Body Weight. By Halbert L. Dunn (*The Military Surgeon*, vol. lii, No. 6, p. 567, June, 1923).—A large number of investigators have made a study of the human foot from the standpoint of mechanics, but comparatively little work has been done with regard to estimating the functional activity of the arch. The investigations contained in this article were undertaken with two objects: (*a*) To obtain knowledge of the arch as a structural unit and a conception of its function in the distribution of the weight placed upon it. (*b*) To demonstrate some of the essential differences between the normal and the broken arch.

The necessary data were obtained in two series—directly from the foot and also from footprints. The determination of the height of the arch was made by measuring the perpendicular distance in centimetres from the tip of the tuberosity of the navicular bone to the floor. Two linear measurements, the medial longitudinal length and the bi-metatarsal width, were obtained by means of a caliper scaled in millimetres. The individual was made to balance himself on one foot in order to apply the body weight in a uniform manner. Footprints were taken for each foot with and without body weight, the fixed bony points having been previously located by ink on the skin so that they were indicated upon the footprint. Both linear and areal measurements were obtained of the footprints, the linear measurements to the nearest millimetre, the area covered by the foot being expressed in values of square centimetres (see fig. 1).

From the data obtained from these measurements, the arithmetic averages of all absolute linear and areal determinations were calculated, also the average per cent of change in all linear and areal determinations when the foot was subjected to body weight alone, and again after the addition of loads of thirty-two and sixty-four pounds. The force was estimated in pounds and the distribution of the force and the stress in pounds per square centimetre upon the anterior, middle and posterior parts of the foot when the foot was subjected to weight. In addition the absolute and percentage decrease of the arch height when the foot was subjected to weight was also computed.

The value of the arch floor height when the arch is subjected to the body weight can be calculated by the expression :—

$$(ab) = \sqrt[2]{(ca)^2 - (cb)^2}$$

when (ab) is the new arch height (ca) is the constant distance already determined from the tubercle of the scaphoid to the tubercle of the first metatarsal, and (cb) the variable distance which has been measured from the tubercle of the metatarsal to a perpendicular line projected downwards from the tubercle of the scaphoid.

In fig. 3 is shown how the stress of different increments of weight are distributed over the anterior, middle and posterior areas of the foot.

The relation of body weight to the incidence of flat foot is shown in fig. 5, the average body weight of 867,757 accepted recruits in the late war was 141·54 pounds, of this number 175,358 were men with flat feet who had an average body weight of 143·24 pounds. The average weight of those with normal feet was found to be 139·84 pounds.

There is a correlation between age and the incidence of flat foot, but the conclusions arrived at show this incidence to be associated with occupational factors.

The arches of soldiers who were measured on the first day after a 1,000 miles march were practically unchanged when they were subjected to body weight, although when examined three days later, they showed as great a depression of the arch when subjected to body weight as did normals.

The conclusions arrived at show that after prolonged marching, the muscles of the foot become unyielding when subjected to body weight, but after a few days' rest become weaker functionally than the muscles of a normal foot. A visual flat is not necessarily pathological, both a high and low arch can be functionally normal, but the high arch has the mechanical advantage over the low arch as a smaller force is required to maintain it when subjected to body weight. The arch is mainly supported by ligaments and the reaction of an arch to static forces depends almost entirely upon the integrity of the ligaments. The best criteria of normal and abnormal arches are functional tests. C. R. S. B.

"Pink-eye" at Epsom College. By Dr. W. M. Scott.

Introductory.—At the time of my visits on November 21 and 27 almost all the cases were convalescent, so that I depend on what I heard from the medical officer, Dr. Ross, for the following account of the symptoms and course of the disease.

Diagnosis.—This has been based on one piece of evidence alone, the reddening of the conjunctiva : the congestion (of both ocular and palpebral surfaces) has been accompanied in the more severe cases by œdema and petechial hæmorrhages with lachrymation and photophobia ; in the convalescent stage there has been persistent slight reddening with excessive

secretion of mucus leading to sticking together of the lids during sleep. I gained the impression, however, that the great majority of the cases during the present term, were cases of slight conjestion of the mucous membrane without other symptoms. All the "pink-eye" boys I questioned (aged from 10 to 18) maintained that they had never felt anything wrong with their eyes. It is obvious that no statistics *re* incidence and spread can be of much value so long as the diagnosis rests on such an indefinite basis.

Course.—The duration of the condition has varied from a few days only to six or more weeks, and relapses have been common after cessation of treatment.

Treatment.—The affected eyes have been douched twice daily (oftener in severe cases) with a lotion containing zinc sulphate and boric acid; the yellow oxide of mercury ointment has been applied in most cases; a few of the more severely affected were treated at first by instillation of silver nitrate solution.

Epidemiology.—The outbreak began early in February of this year, when the first case was followed within three weeks by twenty-three others. In previous years there had been sporadic cases only. In all, during the Easter term, eighty-one cases required treatment (including three masters, one mistress and one servant). Of the seventy-six boys only six were from the lower school (which forms a quarter of the whole school). During the summer term there was nothing more than a sporadic case or two. But on reassembling in September, one case (on the 25th) was followed by a rush of six cases on October 1, all acute, and requiring treatment. Dr. Ross decided on a general inspection, and on October 2, put down 109 (out of the whole school population of about 310) as suffering from "pink-eye"; of these, 38 were in the lower school. Since then other cases have appeared, bringing the total for the term (to November 27) up to 190 (including three maids). But of that large total (60 per cent of the school) only 31 were so definite as to require in-patient treatment. It is this figure which compares with the incidence in the spring term. Hence we have as a table of comparative incidence:—

	College	Lower school
Number of boys	295	81
Easter term cases of "pink-eye"	70 = 33 per cent	6 = 7 per cent
Autumn term cases of "pink-eye"	19 = 8·5 ,,	12 = 15 ,,

It seems plain that the disease at first involved specially the College (boys 12—18) but later spread to the lower school (8—12). Dr. Ross informed me that in the College no house was more affected than any other, and that there was no special incidence or any particular form. It is probable that during the present term a mild and chronic form of the malady has affected more than half the boys, and that the acute cases cropping up from time are partly fresh infections, but chiefly exacerbations of the chronic forms in boys already infected.

Bacteriology.—Only one severe case was available for bacteriological study, a laundrymaid who had had the disease already in childhood. She (on two occasions) and the four boys showing definitely red conjunctivæ, all failed to give any bacteriological growth on (1) Fildes' agar (for hæmophilic bacteria); (2) Griffiths' chloroformed blood agar (for delicate bacteria). Swabs from the congested conjunctiva of the laundrymaid and the three most marked cases among the boys were rubbed one over each conjunctival sac of two Rhesus monkeys. One of the monkeys showed some abnormal blinking on the second day thereafter, but no congestion. On the fourth day both monkeys showed no reaction whatever. Microscopical examination of the secretions at the inner canthus of the eye of these five cases showed a slight excess of polymorphonuclear leucocytes among the mucus and endothelial cells characteristic of these secretions. I found no bacteria or abnormal cell structures in stained films. Similar cultivations and microscopical examinations were made from the eyes of sixteen other boys (seven of them twice at six days interval), who were under treatment, their attack dating from one to six weeks before. Ten of them and four "normal" boys (who had never had "pink-eye") gave no bacterial growth. From the remaining six a variety of different bacteria commonly found in the conjunctiva and nose were cultivated. *Bacillus Hofmann, B. xerosis, Micrococcus catarrhalis* and other Gram-negative and Gram-positive cocci (not streptococci) were found in more than one case. The Koch-Weeks bacillus was found in one case only—a chronic case of "pink-eye." It failed to agglutinate with any of my anti-influenza agglutinating sera, and differed in this respect from other strains of *B. Koch-Weeks* in my possession. The outbreak is not at a favourable stage for bacteriological study, but it is evident that the Koch-Weeks bacillus, to which "pink-eye" has been ascribed by some bacteriologists, is absent from, or at least not commonly present among the cases at Epsom at the present time: it probably has no causal connexion. The disease resembles "common cold" (1) in the absence of immunity after attack; (2) in the absence of a well-differentiated bacterial cause. If susceptible volunteers could be found, "pink-eye" would be a suitable disease in which to attempt to demonstrate a transmissible filtrable virus. It has for this purpose an advantage over a "common cold" in being less widespread in incidence, so that accidental infections of the subjects would be less likely.

Prophylaxis.—In the absence of a bacterial cause the only measures likely to prevent spread are those limiting the chances of eye to eye infection. Certainly, if practicable, a strict veto on the use of a common towel, such as occurs after games, and on the use of books, etc., in common, would diminish the chances of a spread. At present, of course, no prophylactic measures of this kind are likely to be of much avail, as too many of the boys are probably infective. The most useful practical measure would be eye-bathing with a mild astringent antiseptic to form part of the daily toilet of all the boys.

Dermatology. *Il Policlinico* (Serg. Prat.), April 2, 1923, p. 437.

The Present State of our Knowledge of the Ætiology of Herpes Febrilis and Herpes Genitalis. By A. Fontana, *Minerva Medica*, November 18, 1922.—The author, summing up a series of experimental researches into the transmission of the virus of herpes cornealis, febrilis and genitalis, states that in rabbits, which are the most receptive when inoculations are made on to corneal scarifications, a herpetic kerato-conjunctivitis is always produced; in some kinds of herpes thirteen per cent of the cases show very intense lesions and keratogenous encephalitis which is often fatal. With subdural inoculation of the herpetic virus, the picture of keratogenous encephalitis is produced. The virus of the encephalitic material reproduces on the cornea herpetic kerato-conjunctivitis.

Endovenous inoculation of the virus may produce either an encephalitic or keratogenous syndrome.

Rabbits acquire first a local and then a general immunity.

Experimental transmission to man is possible through auto-inoculation on the cornea, and through auto-inoculation or hetero-inoculation on the skin. The transitions from human skin to rabbit cornea, and from rabbit cornea to human skin are positive. The author has not tried the transmission to human skin of the herpetic virus of encephalitis in rabbits.

The herpetic virus is found in the pustules of herpes, in the saliva and in the cerebrospinal fluid of herpetic patients even if they have not got any encephalitic symptoms. The cerebrospinal fluid of epidemic encephalitis does not contain any herpetic virus.

The virus is easily preserved if it is mixed with cellular elements and it is filterable. Kerato-conjuctival lesions (but not encephalitic ones) studied histologically reveal the presence of numerous *nuclear inclusions* (Lipschutz's Clamidozoi strongiloplasmi) and constant *globiform cellular degenerations* (Unna). The herpes zoster virus is similar to the febrilis virus, but is much more attenuated. It is not inoculated on the skin; it does not give rise to general or encephalitic disturbances; it does not immunize the cornea against the virus febrilis.

The virus of epidemic encephalitis has so many qualities in common with the virus of herpes febrilis that it must be considered of the same nature except for its greater virulence and its greater neurotropic electivity.

Eighty per cent of healthy persons have a keratogenous salivary virus which is identical with the herpetic and encephalitic viruses. In fifteen per cent of persons, besides the keratogenous salivary virus, there is also a kerato-encephalitogenous virus which is in all points similar to von Economo's virus. From all these observations put together we deduce that all these viruses are of the same nature, but of different virulence. Levaditi and Harvier maintain that in the beginning there was only one virus with epitheliotropic tendencies (the keratogenous salivary virus) which, acquiring greater virulence, became absolute epitheliotropic and facultatively neurotropic (herpes virus), or epitheliotropic and neurotropic

together (the kerato-encephalitogenous salivary virus of the healthy), and lastly more neurotropic than epitheliotropic (encephalitic virus).

Levaditi, Harvier and Nicolau, moreover, note the affinity of these so-called encephalitic viruses of poliomyelitis, rabies and vaccine, and demonstrate the electivity they have in common for ectodermic tissues.

Mode of Action of Bismuth in Trypanosomiases and Spirilloses. By C. Levaditi and S. Nicolau (*Comptes Rendus de l'Academie des Sciences*. clxxvi, No. 17, April 23, 1923).—Following the demonstration in 1908 by Levaditi and Yamanouchi that atoxyl, which is incapable of destroying trypanosoma *in vitro*, becomes strongly trypanocidal when kept at 37° in contact with fresh liver extract, the authors tested the trypanocidal and spirillocidal action of bismuth salts *in vitro*, alone and in conjunction with various tissues or tissue extracts, using tartrobismuthate of sodium and potassium in one per cent solution. They found that alone or in conjunction with blood, blood serum, egg white, yoke of egg, or yeast, it is not parasiticidal, but when added to an extract or pieces of liver, kidney, lung, mesenteric glands, suprarenal capsule, ovary, brain, or muscles, the trypanosoma or spirilla are first immobilized and then killed, although the effect of the different tissues varies quantitatively. The activating substance of the tissues is thermostabile, although the activated bismuth salt, which the authors call bismoxyl, loses its disinfecting power on being heated to 100° for ten minutes, and is not dialysable.

Review.

Official History of the War. Medical Services. Pathology. Edited by Major-General Sir William Macpherson, K.C.M.G., C.B., LL.D.; Major-General Sir William Leishman, K.C.M.B., C.B., F.R.S., LL.D., and Colonel S. L. Cummins, C.B., C.M.G., LL.D. Stationery Office. Price £1 1s. net.

The pathological volume of the "Medical History of the War" will commend itself to a much wider circle of readers than many of the other volumes do, mainly owing to the fact that the greater part deals with the pathology and bacteriology of many subjects, about which, prior to the war, either much confusion existed or knowledge was scanty. The smaller historical portion on the organization of the pathological services in the field and at home makes interesting reading, especially to service officers, revealing as it does the vast amount of careful thought expended by those in authority in developing a service which became one of the most efficient and fruitful in the war. Concerning the scientific part of the work, it may at once be said that it comprises the record of much new and original

research which is not available elsewhere. Many workers have contributed to the volume, and, in consequence, great differences are noticeable in the individual treatment of each subject. This lack in uniformity is one of the defects of the book; most of the subjects are fully discussed, and the necessary references and bibliography, without which no scientific treatise can be regarded as complete, are appended; these are unfortunately omitted from the Chapters on "Polyneuritis," "Gas Gangrene," and—even more to be regretted—from that on the "Enteric Fevers."[1] Again, though a few chapters are adequately illustrated, it would have much enhanced others had illustrations not been lacking. Without being too hypercritical, it is also unfortunate that such slight errors as "aerobic" for "anaerobic," "M.R.C. Report No. 39" on page 140, should have escaped correction; regarding the binding sufficient care has evidently not been exercised, as at least one copy has some four consecutive pages missing.

The purely historical chapter on "Organization" emphasizes two things—one of the past, the vast debt which we owe to the civilian scientists for their work in the last war; one for the future, the rôle—ever increasing in importance—played by pathologists in the work of the Army.

It is impossible adequately to discuss all the twenty-three chapters, but the following remarks will serve to indicate the value and scope of this volume.

Sir A. Wright has attempted to throw much new light on the exact conditions governing the changes occurring in modern wounds, which he describes under the title of "The Physiology of Wounds." He devotes much of his article to reiterating deductions drawn from his beautiful experiments on the protective powers of the blood, familiar to those who have perused his publications or repeated his experiments. It may be thought unfortunate that he should make use of such new technical terms as "Kataphylactic agents" and "Ecphylactic power," but the *râison d'etre* for their employment is fully explained, and, if one accepts his views, their use is justifiable. The observations made are such that they merit attention by surgeons, especially in their application of antiseptics to wounds; to them also his views on the causation of secondary hæmorrhage cannot but be of peculiar interest. The exact reasons for the good results obtained by the use of that overrated "Dakin's fluid" are given, and its action correlated physiologically with the phenomenon of surface tension. The subjects of surface tension and interfaces in physiology are only in their earliest stages, but the few paragraphs thereon in this chapter should be sufficient to stimulate interest in a subject that will elucidate much of, and correct many views on, the physiological treatment of wounds. That the observations of bacteriologists can influence surgical treatment to a greater extent than is usually thought is proven by a study of the several

[1] A list of references consulted in the preparation of Chapter IX, the "Enteric Fevers," has now been issued.—ED.

chapters on aerobic and anaerobic infections of wounds. It is undoubtedly a fact that so-called secondary infection is not given the attention by those in charge of surgical cases that it merits, and this volume, for these chapters alone, should be a companion to the volumes on the "Surgery of the War." Although the bacteriology of anaerobic infections and gas gangrene is adequately dealt with, it is to be regretted that scanty attention is paid to their exact pathology, especially as interest in such pre-eminently war-time conditions will gradually wane. It is known that the toxin of tetanus is several hundred times more lethal than that of *Bacillus welchii*, and yet death from the latter occurs far more rapidly. An explanation for this may be found in the paralysing effect on the suprarenals, and it has been shown that factors leading to the disappearance of adrenalin from the suprarenal medulla transform non-lethal doses of toxin into lethal doses. The production of acid by anaerobes, hæmorrhage, exposure to cold, all inhibit the adrenalin formation. No mention is made of the pathology of suprarenals or other organs.

Though typhus fever was one of those diseases that bore only a potential significance to medical officers on the Western front, it nevertheless might have assumed importance worthy of the attention paid to typhoid fever after the South African war, especially as knowledge of its ætiology and pathology was extraordinarily defective. One of the finest chapters in the history, is that on this subject, though naturally it deals only with advances made during the war in a subject the research on which is really only commencing. It would be impossible in a short review to discuss adequately many of the observations herein contained, but suffice it, indicating the thoroughness with which the subject is dealt, to state that more than a hundred references are incorporated and appended. It would have been valuable—at least for present-day knowledge—had illustrations of the known pathological conditions, e.g., perivascular accumulation of cells in various organs been included. Closely related to typhus fever, at least possibly ætiologically is trench fever—a fever incident to war—that created much discussion and research. Its treatment in the volume is complete, save again that discussion of the occurrence of Rickettsia bodies is avoided—perhaps justifiably.

Before and during the war much confusion existed about the bacteriology of bacillary dysentery, owing to the mixed nomenclature in use, and the inexact methods adopted for the classification of the numerous strains of bacilli responsible. The chapter dealing with this subject, being a record of the research carried out in the various theatres of war, does much to put the classification on a firm basis, at the same time detailing the methods that should now be employed in the laboratory diagnosis of the disease.

The Medical Research Committee have issued several reports on dysentery, but all the facts therein are contained in this chapter, though the coloured plates illustrating the strains of *B. dysenteriæ* might have been produced. Some one has well said that the opportunity presented by

the recent war for a comprehensive study of the dysentery group has been unrivalled and it has been possible to collect a series of strains on a scale which has never been attained before, and is unlikely to occur again. The results of these researches are contained in this chapter, otherwise, only available by study of very disjointed and confused references. The whole subject of amœbic dysentery has been revised and put on a sound scientific basis as a result of the work of British protozoologists. Some practical points are brought out from these studies which are of interest, viz., that intestinal protozoa in temperate climates are of less clinical importance than might be feared, but as causal factors they must not be overlooked in obscure cases of chronic diarrhœa or other intestinal ailments. The army sanitarian should recognize that chlorine as used in water sterilization does not kill or injure the cysts of *Entamœba histolytica*, and further, Shiga's bacillus can live in chlorinated water which has lost its free chlorine, indicating the necessity for preserving sterilized water from subsequent infection.

The chapter devoted to enteric fevers relates the methods adopted during the war for attaining accuracy in diagnosis, differentiation, notification and disposal of cases; further, an exhaustive analysis of the statistical material collected is given, enabling the value of protective inoculation to be estimated correctly. It is not without interest that Pfeiffer has recently arrived at an almost similar value in his studies of inoculation in the German army, that the marked drop in the incidence can only be attributed to enforcement of inoculation and not to any possible loss of virulence in the organisms. The case mortality in the British Army steadily fell, while in the enemy army towards the end of the war, it rose, due in all probability to the physical inferiority of their recruits. It is, of course, too premature to surmise whether Besredka's vaccine taken by the mouth will efficiently replace the present method of arm inoculation which is shown in this chapter as a triumph in preventive medicine. As Soltau aptly remarks, "The figures as to the incidence of enteric might well be emblazoned in gold in every Royal Army Medical Corps mess as a permanent War Honour, for the grand total of enteric group infections only amounted to 7,423 cases with a case mortality of 3·58 per cent. Contrast this with South African figures, 73,633 cases with a case mortality of 13·7 per cent."

The causal agent of influenza is still the subject of dispute, but until more definite evidence to the contrary is forthcoming *B. influenzæ* must be regarded as initiating the pathological conditions. The histology of influenza, so far as it affects the respiratory system, has hitherto been described vaguely as a form of broncho-pneumonia, in itself, histologically, also a vague term. Professor Adami in his chapter on influenza has shown that such a vague condition previously described as influenzal broncho-pneumonia, has a distinct pathology. No textbook—to the reviewer's knowledge—describes with the necessary minuteness the exact

changes that occur in this disease; so well done in this volume. Influenza is not regarded as a war-time disease, and should Browning's prophecies be heeded, it cannot be looked upon other than as a most dangerous disease of modern times. A knowledge of its exact pathology is essential to an adequate treatment, and two quotations should suffice to engender interest medically "the specific influenza condition is a tracheo-bronchitic and bronchiolitis, with interstitial pneumonia," pathologically "the more powerful toxin (of influenza) set up a characteristically severe type of inflammation with but slight migration of leucocytes; the less powerful induce a characteristic leucocytic type of inflammation."

As lethargic encephalitis is a condition recognized for the first time during the war, and though it caused little anxiety in the medical services, a chapter devoted to the subject is rightly included in the history. It is rather a brief chapter, of the nature of a summary and a full discussion of many facts of interest is omitted. The respiratory disturbances which are of frequent occurrence in encephalitis might have been described in connexion with the pathological changes found in the brain. It may well be that these changes, should they extend to the corpus striatum, account for the attacks of dyspnœa, and the development of shallow breathing and consequent arterial anoxæmia. The vicious circle and pernicious effects that result when anoxæmia and shallow breathing exist have been emphasized by Haldane and others in their study of gas poisoning sequalæ, and a knowledge of such pathological conditions is essential to the correct treatment of symptoms that arise in the course of a disease for which no specific remedy is yet available.

Those to whom the subject of tuberculosis is of interest, will find opened up a mine of new facts and observations in the form of a lucid statistical study of the occurrence of tuberculosis among troops of widely different races, and from remote countries. The behaviour of *B. tuberculosis* among people of high civilization and "urbanized" environment is markedly contrasted with that among races bred under totally different conditions.

The subjects of war nephritis, and cerebrospinal meningitis—the former apparently a war-time condition, the latter of universal importance—are very carefully investigated. Though it is suggested that the former condition may be due to a specific infection, no conclusive evidence was ever forthcoming during the war. The possibility of its being a filter-passing virus is considered, but it would serve no useful purpose at the present juncture to discuss the subject of ultra-microscopic viruses about which our present knowledge is in its infancy.

Nearly every chapter contains suggestions for future work or indicates further lines of research which ought to be prosecuted, both from the scientific and practical aspect. It would occupy too much space to enter fully into these problems but one or two may be usefully indicated. It is obvious from a study of the anaerobes—especially *B. tetani*—that a know-

ledge of the bacteriology of the soil—especially of pathogenic organisms—in different parts of the world is very defective and, considering that the British Army is called upon to fight in almost any country, such a knowledge would be almost essential for adequate protection of the troops. Not far removed from this subject, is that of bacterial symbiosis about which also little is known, and which played unfortunately an important rôle in infection of wounds and in various diseases. Much important information could be obtained by a study of symbiosis *in vitro*, and also by animal experiments. Again information based on the study of statistics and experimental research might be collected on the important subject of so-called "Principle of Redistribution." It is known that where large numbers of individuals have lived together for some time a certain amount of immunity is acquired to the prevailing strains of infection, meningococci, pneumococci, etc., and that a "carrier" of a given strain who has "conferred" this immunity to those among whom he lived, if drafted to another collection of men, may spread the disease. An exact knowledge of such conditions is very essential from an army point of view. Indeed the suggestions for immediate future work are many.

In conclusion, it can be stated very crudely that this volume, which is priced at one guinea, contains a record of the researches of Britain's most eminent pathologists on subjects hitherto vaguely understood, and for the first time presented to those who have neither the time nor the opportunity to investigate all the progress in the study of the pathology of disease made during the last war.

A. MEARNS.

Correspondence.

COLLECTION OF TYPE STRAINS OF PATHOGENIC MICRO-ORGANISMS AT THE ROYAL ARMY MEDICAL COLLEGE.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—I would be glad if the following could be brought to the notice of officers interested in bacteriology.

A collection of type strains of the various pathogenic organisms is maintained in the Pathological Department of the Royal Army Medical College, and cultures of these strains can be supplied on demand.

It is obvious that much assistance in the identification of organisms isolated from various pathological lesions can be derived by comparison with known type strains. The above collection exists and is available for that purpose.

I am, etc.,

H. MARRIAN PERRY,

Brevet Lieutenant-Colonel R.A.M.C.,

Professor of Pathology, R.A.M. College.

November 23, 1923.

Notices.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts, and commands at home and abroad.

All such Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notified at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Any demand for *reprints, additional to the above*, or for excerpts must be forwarded at the time of submission of the article for publication.

Matter intended for the Corps News should reach the Editor not later than the 15th of each month for the following month's issue. Notices of Births, Marriages, and Deaths are inserted free of charge to subscribers. All these communications should be written upon one side of the paper only; they should by preference be type-written; but, if not, all proper names should be written in capital letters (or printed) to avoid mistakes, and be addressed: The Editor, "Journal of the Royal Army Medical Corps," War Office, Whitehall, S.W.1.

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Original Communications.

THE PRESENT-DAY TREND OF TREATMENT OF GONORRHŒA, WITH SPECIAL REFERENCE TO CATAPHORETIC APPLICATION OF COLLOID SILVER.[1]

By MAJOR A. T. FROST, O.B.E.
Royal Army Medical Corps.

AFTER the discovery of the causative organism of gonorrhœa drugs were applied to the urethral mucous membrane with the intention of killing the organisms with which they come in contact. Later, when it was realized that no antiseptic could reach the organisms which are buried in crypts and follicles and are beneath the surface epithelium, lavage with weak antiseptics became the routine procedure. But as this treatment meant merely waiting until the patient cured himself, various methods of attack have been devised within the last fifteen years. A number of metal instruments have been added to our armamentarium, some of them are of value in diagnosis and others are of use in destroying the local foci of disease which delay cure.

At the beginning of the present year, the staff of the Military Hospital, Rochester Row, came to the conclusion that two lines of investigation might be tried: (1) to try to bring antiseptics into contact with the gonococcus through the blood-stream, and (2) to drive antiseptics into the deeper foci beneath the surface layers of urethral epithelium.

Lieutenant-Colonel T. E. Harty, D.S.O., R.A.M.C.(R), had carried out a series of intravenous injections of acriflavine at the Military Hospital, Portobello, Dublin, in October, 1921. In the fifty-five cases treated, he

[1] Read at the Meeting of the War Section, Royal Society of Medicine, November, 1923, and published by kind permission of the Society.

reduced the stay in hospital to 37·1 days. He noted that those cases which reacted to treatment did so early, while others continued to show gonococci for one month after beginning the treatment. The number of days under treatment before the disappearance of gonococci was thirteen. The method employed was intravenous injection of 0·2 gramme of acriflavine dissolved in 200 cubic centimetres of physiological salt solution. This dose was increased to 0·3 gramme in 300 cubic centimetres saline solution on the fifth day and repeated on the tenth day. During this course the urine was kept alkaline.

In October, 1922, a similar series of cases was given this form of treatment at the Royal Herbert Hospital, Woolwich. The average time in hospital for eighty-six men was 59·71 days. As the colour of the skin of the men became a lemon yellow as soon as the injection was within the veins, it was thought that the coloration of the skin and rapidity of elimination might be prevented if the drug could be given into the muscles or under the skin. The first attempts were not successful owing to the bulk of the injection used, 0·3 gramme in 100 cubic centimetres, and the inflammatory reaction which followed. Moreover, it was found during tests for toxicity on rabbits, that the animals died from acid intoxication when given a lethal dose of acriflavine. Numerous experiments were then undertaken to solve the problem of the removal of the acid in the preparation, which equals 3·5 cubic centimetres of normal hydrochloric acid for every gramme of the acriflavine, and to make the injection under the skin small in bulk and painless. This was done by adding 3·5 cubic centimetres of normal sodium bicarbonate to one gramme of acriflavine and diluting with distilled water up to twenty cubic centimetres to bring down the content of sodium chloride to one per cent. Two to seven cubic centimetres of this solution may be injected under the skin, just over the muscle fascia, with no great pain resulting. Two sites have been used for the injection, one between the shoulder-blades, the other behind the great trochanter of the femur. Three doses have been given as a course with a five-day interval. The investigations are still being continued. The figures accumulated up to date are of little value owing to their small numbers, but indicate a stay of 39·1 days in hospital. In chronic gonorrhœa some most successful cases have been met with. To quote one case as an example. A soldier was transferred from another station with a history for one year of a urethral discharge, containing gonococci; three deep subcutaneous injections cured the disease and he has been free from recurrence for the past six months.

One difficulty remains unsolved. This neutral solution does not keep well; it must be prepared freshly at least once a week, otherwise it becomes irritating to the tissues.

Up to the present acriflavine is the best of the dye products as a bactericide. This field of research is only opened and further results may be expected from the discovery of new dyes in the future.

Since the month of May, 1923, a new method directed against the gonococcus has been in operation at the Military Hospital, Rochester Row, and continued at the Royal Herbert Hospital, Woolwich, since the closure of the former hospital in July. The origin of the work was the production by electrical methods of a pure silver colloid, which is stable in distilled water, by Major S. H. Long, D.Sc. This colloid was first used at the Indian Station Hospital, Karachi, on cases of gonorrhœa. A silver catheter with multiple perforations was introduced into the urethra and attached to the positive pole of the electric supply. The catheter was filled with the colloid and a small current of electricity was sent through the urethra—that is, *the method was assumed to be ionization*. The findings were so promising that the matter was referred to the Military Hospital, Rochester Row, for further investigation. Examined chemically, the colloid was found to have no added protective; the particles were of small dimensions; it was not precipitated by 0·5 per cent sodium chloride in three days, and one per cent sodium chloride took three hours to destroy completely the colloid. Electrically, as the medium is a non-conductor, it was found that the colloid particles moved from the negative pole towards the positive pole. Bacteriological experiments, using a culture of staphylococci isolated from the urethra, showed that 1,000 million organisms were destroyed in twenty minutes, and that 300 million were killed in 2½ minutes by the undiluted colloid.

During the above chemical investigations, a week's trial was given of the ionic method of using the colloid, but the method had to be abandoned owing to the pain and discomfort of the catheter within the acutely inflamed urethra. It was then decided to try the effect of using the colloid cataphoretically, that is, applying electric pressure and not electric current through a column of the silver colloid within the urethra.

It is to be noted that the colloid consists of electro-negative particles which move distinctly towards the positive pole when subjected to an electric pressure, as shown by microscopical and electrical tests. Therefore, this method tends to drive the colloidal particles into the urethral mucous membrane when a column of the silver suspension is acted on by a pressure of sixty volts or over direct current through the negative pole, with the positive pole attached to a perineal pad. Sixty volts direct current is the minimum pressure which will set the colloidal particles moving towards the opposite pole.

After some experimental work on details, the following method of carrying out the treatment was adopted:—

A room is wired for the treatment of ten patients from a 106-volt direct current supply. Ten electrical points are distributed round the walls of the room, each with a plug and switch connected in parallel, through a switchboard, with the source of electrical supply. Two wires from the wall plug bring the electrical energy to the patient. One wire is positive, the other is negative, and each wire is marked, after test, with its polarity

The positive connexion is attached to a wire gauze pad which is wrapped in several folds of washed lint, and on this the patient sits. From the pad an extension is brought forward to enclose the shaft of the penis. The pad is wetted with saline solution. The negative wire is attached to a one-inch length of silver tubing which is inserted into the lower part of the rubber tubing of an irrigation apparatus consisting of a 300-cubic-centimetre funnel and five feet of rubber tubing with a glass urethral nozzle attached. A piece of silver wire is soldered to the inside of the silver tube and extends down to the glass nozzle.

The patient sits on a chair and on the positive pad. The funnel, suspended on a stand, or by a wire beside him, is filled with colloid silver, air is expelled, and the bladder and urethra are filled with the colloid by pressing the nozzle firmly into the urethral meatus.

With the sliding resistance on the switchboard at zero—usually marked "weak"—on the board, the current is switched on. Next the switch at the point on the wall for the patient is put on and the sliding resistance moved towards "strong" until all resistance has been cut out. If ten cases are to be treated, this is not usually done till all the cases are ready. There is practically no rise in current—even with ten patients the milliammetre does not register more than one milliampere, but the pressure shown is 106 volts. In order to prevent burning of the patient due to excess of current which might be caused by an accidental short circuit one wireless receiving valve has been introduced into the circuit in series with the supply voltage on the patient's side of the switchboard. This valve acts as an automatic cut-out. Even on a dead short circuit the valve will prevent a current of more than eight milliamperes from passing through the patient, which is harmless even at the high voltage used. So that the use of this high voltage for medical purposes is feasible and can be manipulated by anyone without electrical knowledge once the circuit is installed by following a few simple directions.

The routine followed for treatment is that the patient has a dose of 20 million gonococci injected subcutaneously, and his urethra is washed out with lime-water to remove mucus, and then with distilled water to remove electrolyte. The patient then sits on the chair, fills his bladder and urethra as mentioned, and the voltage is applied for three-quarters of an hour to one hour. If during the treatment the amount of fluid in his bladder is causing discomfort, or if the amount of urine secreted into the bladder is sufficient to act as a conductor, the bladder is emptied and again filled with colloid. This treatment is repeated daily for four days until the patient's urethra is dry and free from discharge. He then goes through a test for cure, and is discharged from hospital when no signs of recurrence is brought out by the test.

If it happens that the urine is not clear at the end of the first set of four applications of silver colloid, the patient receives a second injection of antigonococcal vaccine, and has a Kollman's dilator passed, and

immediately after it he is again treated cataphoretically. It has been found that those cases which require further treatment have a number of closed follicles in the urethra, as seen by the urethroscope, and when these are opened, that the cure could be completed by one or two further applications of the silver colloid.

The test of cure consists of a complete examination of the urethra after irrigation with magnesium chloride 1 in 500 solution twice a day for two days, preceded by a 100 to 200-million injection of gonococcal vaccine.

The examination consists of the introduction of a sound, followed by inspection of the urethral mucous membrane by means of the urethroscope; prostatic and vesicular massage with microscopic examination of any secretion expressed from them. The urine must be free from pus, and no pus must be present in the urethra.

As this treatment can only deal with urethral infection, it has been decided that if a preliminary examination of the prostate gland or the vesicles shows that the disease has reached them, or signs of any metastatic disease due to gonorrhœa are found, a deep subcutaneous injection of two or three cubic centimetres of a 1 in 20 solution of acriflavine is given at intervals of from three to five days. The sites chosen for injection are over the deep fascia behind the great trochanter.

The number of cases which have been subjected to the combined treatment are too few for the estimation of its value. The difficulty experienced is in getting into the blood and urine a sufficient concentration of acriflavine to be within the bacterial lethal dose. Tests of some serum and urine show that with a subcutaneous injection of 0·1 gramme the urine concentration was about 1 in 50,000, and in the serum the dilution is ten times greater, which suggests that definite results will be obtained with higher doses; it was also found that the acriflavine concentration was negligible on the third day, it had been so rapidly excreted.

During the test of the electrical colloid treatment daily examinations of microscopic slides have been carried out. Two points looked for are: (1) the presence or absence of gonococci and their number per field; and (2) the proportion of epithelial cells to pus cells present in the discharge. The first gives a rough estimate of the acuteness of the infection, while the second gives an indication of the stage of the disease. If daily microscopic slides are taken of a case of gonorrhœa from the beginning of treatment, it is found that the findings as regards both points can be plotted and the curves run practically parallel. Examination of microscopic slides even when made only twice a week, can thus be used, as a quite reliable indication of the urethral condition and the progress of the case towards recovery. In chronic cases where the finding of gonococci is difficult, the cell ratio gives the clue the patient's progress, and directs the treatment. To obtain comparable results, it is, of course, necessary to take the smears in the same way, and for quickness and reliable counting of the cells the pus should be spread like a blood film for malaria examination or a

differential count. The results of the electrical treatment of 107 cases give the following figures:—

Total number of cases treated and discharged hospital as cured	...	107
Average number of days under electrical treatment	... ...	9
,, ,, ,, in hospital	... ...	28·9
,, ,, ,, under observation after treatment	...	13
,, ,, ,, in hospital, at two large venereal hospitals, in the year 1922	... ...	69·2

It appears to the officers working this method of attack on gonorrhœa that it is more than an experiment, and that it opens up a field of work which promises success when the method is perfected. At present there is further work to be done as to the most efficient voltage required to get the quickest cure. Also, only one non-conducting colloid has been tried, others may give better results, or this colloid may be improved. The object of this paper is to indicate the work done in the hope that others may try the methods described, and that we may arrive by co-operation at the scientific facts on which to base the medical control of gonorrhœa, at which point we have not yet arrived.

PARASITIC MITES ON MOSQUITOES.

By Captain W. H. DYE.
Royal Army Medical Corps.
Medical Officer, Nyasaland Protectorate.

While making a collection of mosquitoes indigenous to the northern part of Nyasaland, I was struck by the frequency with which certain species appeared to be covered with minute red globules which on examination with a hand lens appeared to be eggs. Under the microscope, however, it was noticed that what had appeared an oval-shaped egg was in reality a small arthropod, resembling in general outline a minute tick. On gently detaching some of these with the point of a pin and examining with a low power, a feeble-moving six-legged creature was seen, laboriously crawling across the slide.

Dr. Balfour's article in the February number of the Journal of the Royal Army Medical Corps arriving at this opportune moment, I was spurred to take a greater interest in these small arthropods.

Finding that it was extremely difficult to make permanent preparations showing the essential details of structure, owing to their minute size and their habit of retracting the legs and mouth parts when dying, it appeared to be of more value to make accurate detailed drawings from the living insect and to study their life history with a view to throwing some light on their genus and species, as from Dr. Balfour's article I gathered that there must be a considerable variety of species of this type of mite which attacks mosquitoes. This must be my apology for writing an article on a subject I am so little qualified to investigate.

The following species of mosquitoes were found in this district :—

Anopheles costalis.
Anopheles (myzomyia) nili.
Anopheles (myzorhynchus) paludis.
Anopheles funestus.
Anopheles pharoensis.
Mansonia uniformis, var. *africana.*
Culex fatigans.
Culex tipuliformis.
Culex bitæniorhynchus.
Culex tigripes.
Culex decens.
Stegomyia fasciata.

They were chiefly collected in the houses of the Europeans stationed here and in my native hospital. The native huts were found to be of little use for collecting purposes owing to the smouldering wood fire kept con-

stantly burning, which creates an atmosphere intolerable to the European, and must make these huts completely mosquito proof.

Of the above list, *M. uniformis* is by far and away the commonest species, both indoors and out, being a ferocious feeder at all times of the day and night. Next in order of frequency comes *A. paludis*, which after sundown is in almost as large numbers as the *Mansonia*. *A. costalis*, *C. fatigans*, *A. nili*, and *A. funestus* are frequently found, the rest being but occasional visitors. Many hundreds were collected alive and a systematic search for these little parasites was made, and the following approximate figures were obtained:—

(1) During the latter part of the rainy season, March, April and May:—

M. uniformis, fifty per cent females, no males infected.

A. paludis, forty-five per cent females, no males infected.

A. pharoensis, ten per cent females, no males infected.

C. fatigans, one female only found infected with a single mite.

(2) During the cold weather, June, July and August:—

M. uniformis, five per cent females, no males infected.

A. paludis, two per cent females, no males infected.

The other species prevalent here were never found to be infected.

With reference to the apparent immunity of the males, it should be mentioned that the number of males examined was only a fractional part of the whole number, but in no case was a male found to carry one of the insects. Experimentally it was found impossible to persuade a mite detached from a female mosquito to take a permanent hold of a male *Mansonia*. This, however, was an experiment of little value, as it was found that they were loath to take a definite hold after once being detached, although it occasionally happened.

Much confusion was experienced until it was discovered that there were at least two very closely allied species present, and that they could be differentiated in their larval stage, when present on the body of the mosquito, by their size, colour, and often by their position on their host, as there were no structural differences present until development had taken place after removal from the mosquito. Both species presented much variability in size, but one, called for convenience "the small brown species" was found never to exceed 350 microns in length of body, and was a deep red brown colour, while the other called "the large red species," was often found as large as 550 microns and in colour was a bright vermilion red. The former was always found attached to the thorax of the mosquito, most frequently between the coxæ, but often just under the junction of the wing with the body, close to the second thoracic spiracle. This type of mite was never found attached to the abdomen. The latter or "large red species," which in an heavily infected mosquito always formed the higher percentage, was more frequently found attached to the abdomen, although the thorax was by no means immune to attack. In a typical heavily loaded mosquito a group of three or four small brown mites

would be found on the thorax, and ten to twelve large red mites attached to the lateral and ventral walls of the abdomen in rows. As many as seventeen of these little parasites of mixed species have been found attached to a single mosquito, while on the other hand it was not uncommon to find but a single passenger. The average ranged about six to eight per infected mosquito. Although very large numbers were examined, as mentioned above, the details of structure other than size and

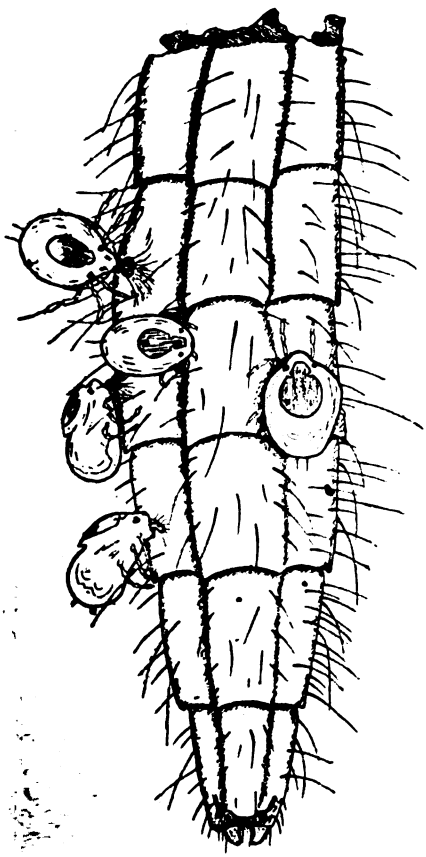


FIG. 1.

colour, appeared identical in the stage of development present while living on the mosquito, and therefore the following description will apply to both.

In situ, they appeared as egg-shaped bodies, either dark brown or bright red in colour, with deeply pigmented purple eyes and conspicuous mouth parts. In side view they had rather a grotesque appearance, owing to their snout-like rostra and stumpy legs. They were firmly

anchored to their host by the attachment of their tarsal claws to the adjacent bristles, and by their claw-like pedipalpi to the surface of the mosquito's body. Careful examination of fortunate specimens showed that the tissues of the mosquito's body were pulled up towards the parasite by the action of the pedipalpi (fig. 1). Various attempts to kill and clear a specimen without the mite leaving its host were eventually successful,

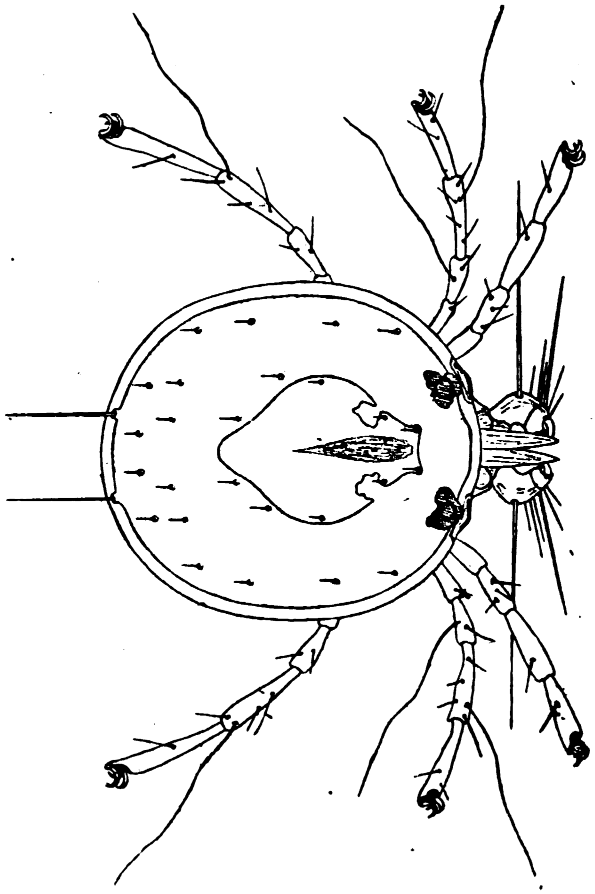


FIG. 2.

and one specimen was obtained which showed the hypostome driven a short way into the tissues of the body.

Removed from the host and examined with a higher power the following additional details could be made out.

The pigment of the body was not evenly distributed all over, being made up of numerous and varying sized globules which had an oily appearance when the body was crushed and were not soluble in xylol. These globules were also present in the legs. The eyes, four in number,

were composed of a large anterior pair, and just behind a smaller posterior pair. Both pairs were deeply pigmented with a deep purple finely granular pigment. On removal of this pigment the eyes appeared as simple ocelli, with clear shining lenses (fig. 2). The mouth parts consisted of three jointed pedipalpi armed at the tip with a formidable claw, and the last two segments being also armed with stout bristles (fig. 3). The two very long whip-like bristles as shown in figs. 2, 3 and 5 were very constant in position and size. Some of the other bristles appeared rather variable. The remainder of the mouth parts, which were extremely difficult to make out, appeared to consist of cheliceræ armed at the tip with a fine hook and a bifid, finely pointed hypostome, which could be extruded or retracted at will, covered dorsally with a sheath split at its distal end.

FIG. 3.

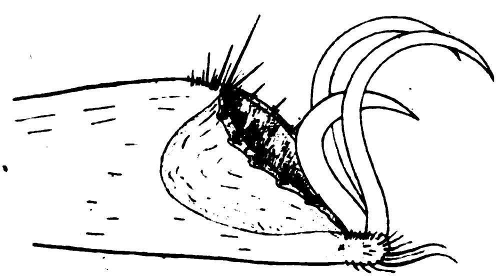


FIG. 4.

The six-jointed legs ended in a trifurcate claw (fig. 4), of which the centre one was shorter and stouter than the lateral two and was frequently retracted back into the depression in the last segment, which caused it to be missed for some time. The bristles on the legs were rather variable in position and number with the exception of the long whip-like hairs on the second and third legs.

The body when cleared of pigment showed a clear shining chitinous surface seen well at the periphery, with a definite arrangement of short dorsal bristles, and two long posterior bristles, which latter were very conspicuous in all specimens. The ventral surface showed three pairs of shields, and the anal opening lying posterior in the medio-ventral line (fig. 5).

From their structure it was obvious that this was the larval stage, and experiments were performed to try and find out their further life history.

After careful removal from the mosquito some were placed on dry earth, others on moist earth, and again some on stalks of grass. All these died within a few hours, but if dropped off into water, it was found that they

remained floating on the surface, apparently lifeless, for a period of three to eight days, when moulting would take place and an eight-legged actively moving adult emerge, swimming about the bottom of the glass dish with great rapidity and vigour.

During the early months of the year a very small percentage gained the adult stage. On the other hand during the dry months of June, July and August, not only did a much higher percentage of mites, detached from the

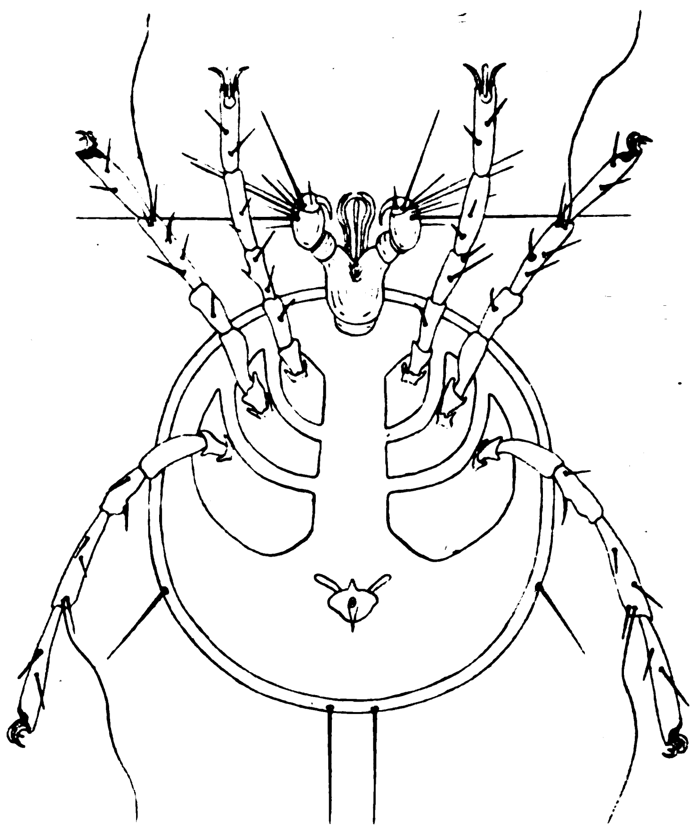


FIG. 5.

mosquito and placed in water, proceed rapidly to develop, often as many as a hundred per cent, but in addition they readily detached themselves from the body of their host as soon as it was dead. This had never happened in the earlier part of the year, forcible separation being necessary, otherwise the mite was enveloped in the general decomposition of its host. As the months proceeded this latter trait became more and more evident, the mites detaching themselves from the mosquito, within a few minutes of its death, and showing quite considérable pedestrian powers, travelling

rapidly over a sheet of paper nine inches wide. If, however, they were not put in water within a short time, they shrivelled up and died. These small swimmers, when first developed, retained their larval distinctions of colour for about twenty-four hours, and then a distinct alteration in colour and appearance took place.

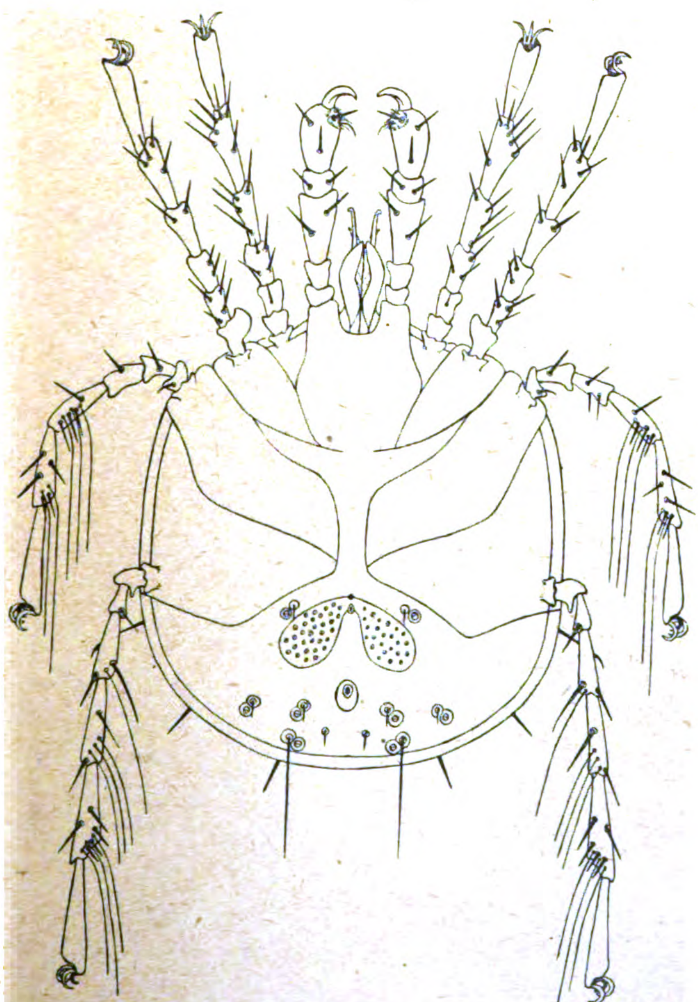


Fig. 6.

The "small brown" larvæ developed into two distinct types, one dark reddish in colour with a body measurement of 350 microns, the other slowly developing into a light lemon yellow species with a similar body measurement. Barring the very marked difference in colour, no distinction in structure could be made out between these two and they will therefore be

described together. The "large red" larvæ developed into adults with a body measurement of 550 microns, and were a reddish brown colour, with marked structural differences as compared to the other two species. All three types after development had proceeded for a few days, lost the globular pigment from all the appendages, these latter becoming a translucent green colour, no pigment being visible microscopically.

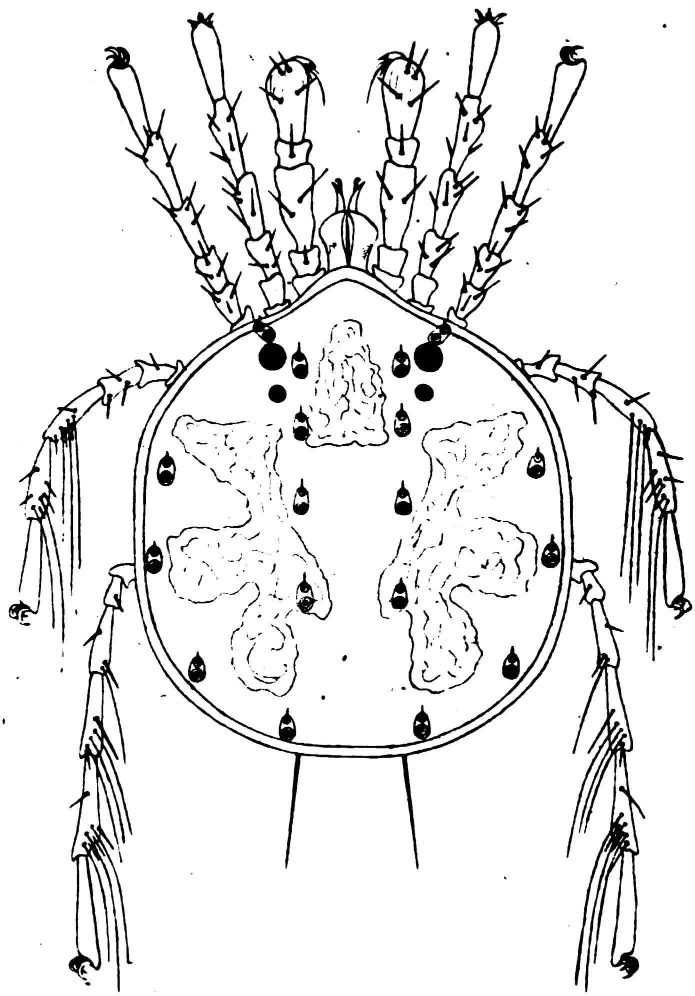


FIG. 7.

Microscopic examination of these adult mites while still alive presented the following details and differences :—

(1) Small brown and yellow species (figs. 6, 7 and 8).

The pedipalpi had increased markedly in size and had become five-

jointed. The tip was still armed with a formidable claw, opposed by a stout bristle situated on a papilla at the root of the claw (fig. 8). Of the two whip-like bristles, the one on the second segment had disappeared, and the other had become much attenuated. The chelicerae were still present as fine hooks, while the hypostome appeared to consist of two symmetrical lancet-shaped blades, which could be extruded to a considerable distance, but were usually kept retracted and out of sight. All the legs, including the post-pair, now consisted of seven segments, all armed with trifurcate claws. The solitary whip-like hairs present on the second and third pair of legs in the larval stage had disappeared and were replaced by groups of swimming hairs on the fifth and sixth segments of the third and fourth pairs of legs. The number of these hairs did not seem to be sufficiently constant for classification purposes (fig. 7).

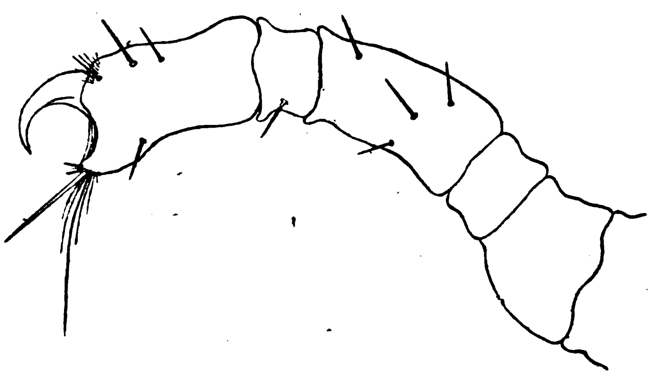


Fig. 8.

The bodies of these fully developed mites lose much of their egg-shaped appearance in side-view, being very much flatter and in shape can be likened to a non-engorged tick. The four deeply purple pigmented ocelli remain and could be seen to be slightly pedunculated, having a small but definite range of movement, but the scutum had become involved in the general chitinous surface of the dorsum, which in the lateral view had a definite sharply defined edge. The arrangement of the bristles is shown in fig. 7, the two conspicuous post-bristles being evident. Close to each bristle and partially connected to it, there is a circular pit, the function of this not being evident unless it is respiratory. The chief differences of the ventral surface are the arrangement of the ventral plates and the appearance of the genital pore. In addition there is a bilobed plate which appeared to be covered with multiple small perforations (fig. 6). No stigmata could be seen unless the peculiar pits found adjacent to each bristle are to be looked upon as multiple stigmata.

As stated above, these details of structure apply equally to both the small brown and small yellow species, the difference in colour being the

only distinguishing mark, and after clearing in xylol differentiation being impossible.

(2) Large brown species (figs. 9, 10, 11 and 12).

This on account of its greater size was much more satisfactory to study. The massive pedipalpi were found to be composed of five segments, the first two segments being very short, the major portion being composed of the last three. The terminal hook was found to have been replaced by a triple claw as shown in fig. 9. The hypostome was easily demonstrable, and was seen to be composed of two stout straight lancets, saw-edged on their median surfaces, the chelicerae being tipped by small hooks (fig. 10).

The seven segmented legs differed from the preceding species in having double compound claws on the first three pairs of legs (fig. 11) and no terminal claws at all on the fourth pair, this latter ending in a pointed tarsus, adorned with some short swimming hairs, and on the median side with six stout, constantly present, bristles (fig. 12). In addition, the sixth

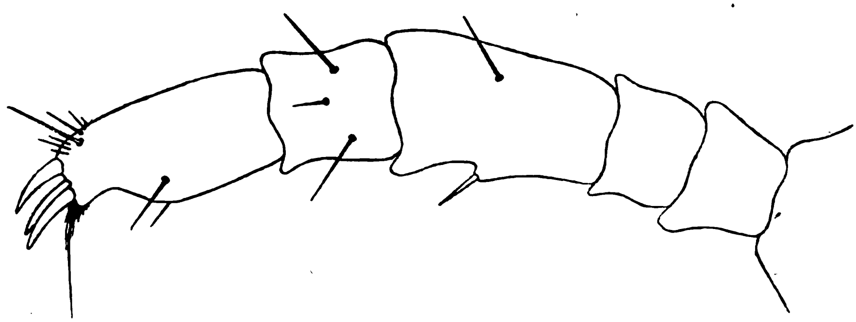


FIG. 9.

segments of the third and fourth pairs of legs in this species have conspicuous attachments shown in fig. 12, which gives the appearance of very stout blunt bristles, slightly feathered.

The dorsal surface of the body (not figured), has nothing of note, and bears a general resemblance to the dorsal surface of the smaller species already described. The ventral surface shows a slightly different arrangement of plates, the bilobed? perforated plate being replaced by a very distinctive plate containing some? perforations and four disc-like structures, which in spite of their comparative large size did not yield any details when examined under a high power (fig. 10). The two post-bristles were still well marked and both dorsal and ventral bristles were found to have the peculiar little pits adjacent to them as described above.

What the future of these small water mites might be became rather a problem. A variety of fresh water animalcule was added to the dish which contained a large number of adult mites. These mites, although quick swimmers, are not capable of competing with the ordinary hydrachnidae, which are so common in the stagnant pools, and in time they fell a prey

to some of the bigger types of predaceous water arthropods. They ignored slow moving organisms, but on adding the hairy larva of a species of dermestes to the Petri dish in which they lived, they attacked this with

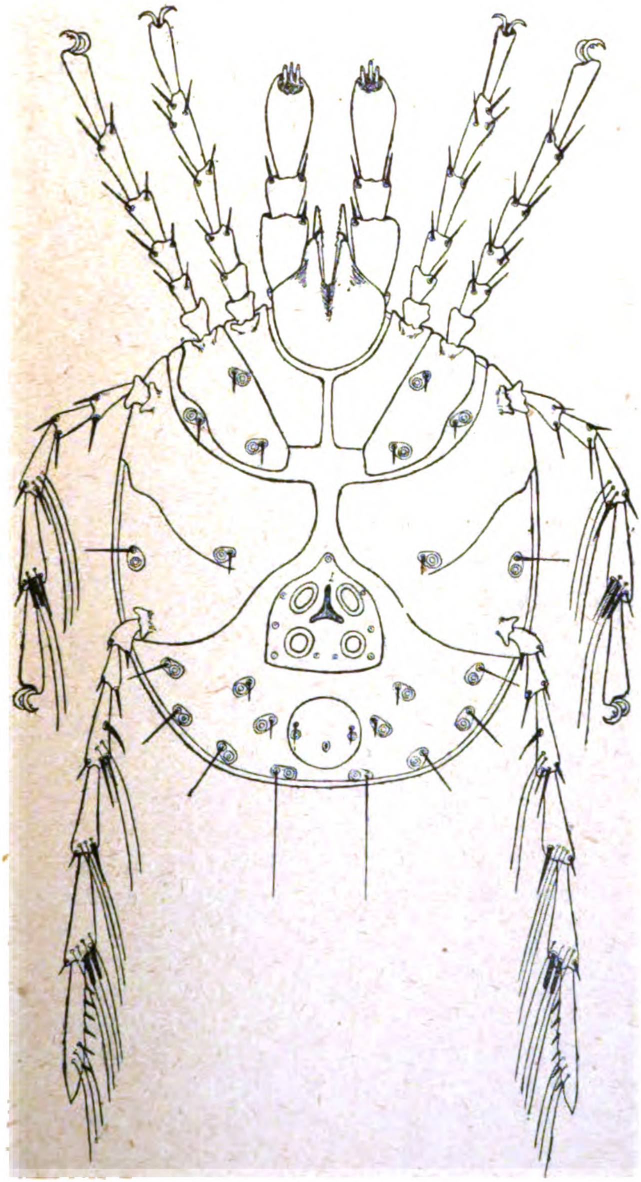


FIG. 10.

great ferocity, working their way between the hairs until every mite had disappeared from view. On another occasion I added a piece of the skin of the small black bat, to which I left a portion of flesh attached. This

too appeared very attractive, but the hair side only was attacked, the mites again getting completely out of sight. The hairy object appeared to attract in virtue of its value as food, and not as a protective, as a small loosely twisted ball of grass, which would appear to supply good and attractive natural cover, was ignored.

As it seemed probable that, with such ferocious mouth parts and well-armed tarsi, living and not dead animal matter must be their natural prey, and as the hairy surface of the maggot and bat attracted so readily, it was deemed possible that they might ascend the legs of cattle or wild game and complete their existence on vertebrates. This, however, was disproved. Two or three mites were carefully removed from the dish in which they had undergone development, and put with some small drops of water on my arm. They continued to swim about actively in the drop of water, but

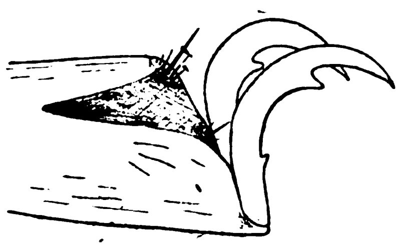


FIG. 11.

FIG. 12.

made no attempt to attach themselves either to the skin or to the hairs of my arm. As soon as the water had evaporated, however, they shrivelled up and died, and did not recover when replaced in water. Apparently they are not able to survive even for a few minutes out of water in their adult stage of existence. Up to date I have kept these mites alive for sixty-five days, without adding any food to the dish in which they originally developed, but allowing the water to go stagnant and adding a few pieces of grass to increase the development of small water organisms.

Copulation has never been noticed to take place between any of these species, but owing to periods of absence while travelling the district, accurate observation has not been possible. It appears probable, however, that these little parasites get attached to the mosquito, either when it is hatching out, or resting on the surface of the water, very early in their career, as some minute ones were found early in the season. I have never found a mosquito larva or pupa parasitized, but as the larva and pupa of

the *Mansonia* do not rise to the surface of the water this may account for the heavy infestation of this particular species. I have searched the pools carefully, and have never been able to detect in the sediment obtained therefrom anything that bore any resemblance to the mite in question. This would, however, be very difficult to do, if, as I believe, they get attached to their host shortly after hatching, and while microscopic in size. That they grow and develop on the mosquito can be proved by the fact that very small ones knocked off fail to develop out in water, and that they are definitely larger as the season advances. The mosquitoes caught locally in the months of July and August must have hatched out during the rainy season, as the breeding grounds are too far away during the dry weather to supply new arrivals. Also the fact that the larger the larvæ the higher the percentage that will develop out when removed from the host, is confirmation of this point.

No blood corpuscles were ever found in crushed specimens, and it seems doubtful if their mouth parts are long enough to pierce to the mosquito's stomach. I am inclined to think that they feed on the body fluids of the mosquito.

Whether they do much damage to their host it is difficult to say. The latter's powers of flight seem to be unimpaired, but the drop in the percentage of infected mosquitoes as the season advances is suggestive. The mosquitoes in this district though not so plentiful as during the latter parts of the rains, are prevalent during all months of the year, and no great lessening in numbers is noticed until the bush fires take place in September and October. Infected mosquitoes kept in captivity did not survive many days, but the method of keeping them was admittedly not ideal, and too much weight must not be placed on this point.

It would appear that the mites, when fully developed larvæ, detach themselves when the mosquito returns to water and there develop into the aquatic adult. Here they apparently feed on some water animal or organism that is most probably covered with hair and remains constantly submerged. The rest of their life history is at the moment a matter of conjecture, but the water in which many of these mites have lived for some considerable time is being kept in as near an approach to the natural conditions as possible, and at the beginning of the rains in December next, it is proposed to add mosquito larvæ to it when it is thought it may be possible to demonstrate the earlier stage of the life history if my suppositions are correct.

With reference to the quotations in Dr. Balfour's interesting article (Major Boyd's previously published article is unfortunately not to hand), I do not think that the colour of the mites is due to blood ingested at second hand, otherwise some pale ones would have been found, and what is of still more importance, the adults retain the colour, either intact or with alterations specific in character. It appears certain that the green ones seen by Dr. Balfour in the Sudan, and by other observers in other

parts of the world, must be of a different species. The various biting flies which distinguish this country by their presence, and vary from *Tabanus biguttatus* to Simuliidæ, were examined for parasitic mites. Specimens of *Stomoxys niger* were the only ones to harbour mites visible to the naked eye. These however were entirely different and, as shown in fig. 13, were the larval stage of feathered mites.

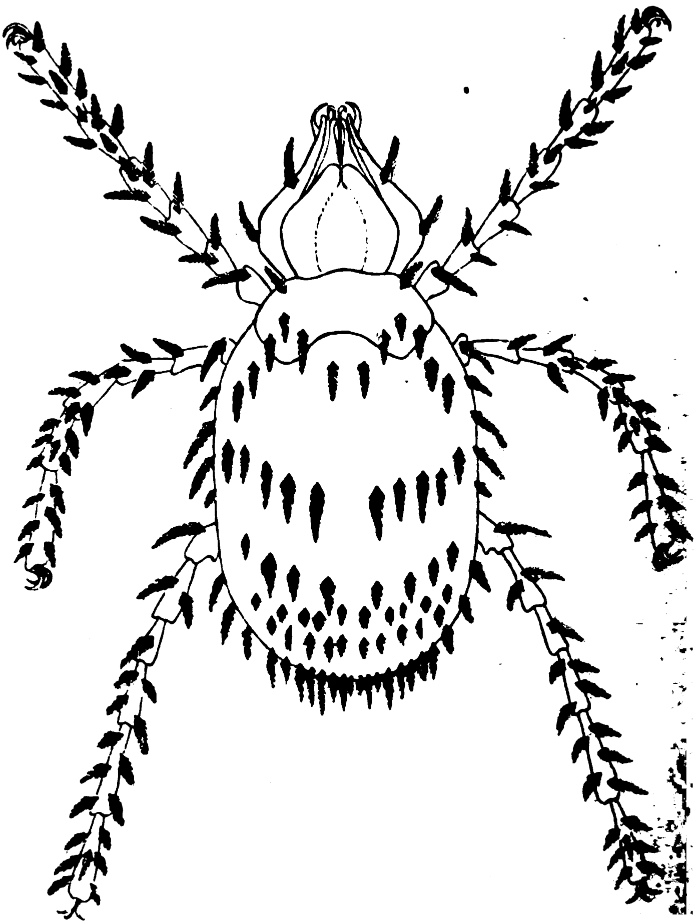


Fig. 13.

Many ways of mounting these delicate specimens were tried, but the most successful method both for the larvæ and adults was found to be as follows: The living insect is placed gently on a glass slide and covered with a small drop of water. A cover slip is gently let down, the drop of water easing the pressure and allowing the appendages to be extended. The slide is left for twenty-four hours when it will be found that the mite has died with extended legs as the water has dried. If the cover slip is

gently raised with the point of a pin the mite will be found adhering to the glass slide. Xylol can now be added and the specimen watched under the microscope until completely cleared and then mounted in Canada balsam. Absolute alcohol is not necessary if the specimen is left to dry for twenty-four hours as described above. Balsam mounted specimens, however, do not show the swimming hairs or finer bristles well, and for these the living specimens placed in glycerine to retard their movements are required.

The classification of these parasites is difficult. The larval stage has a very strong resemblance to the larvæ of Trombidiidæ.

Max Braun (translated by Sambon) gives as a definition of the Trombidiidæ, "soft-skinned acarina with tracheæ, and with two eyes usually pedunculated: they are often brightly coloured; chelicerae lance or claw-shaped; pedipalpi claw-like; legs composed of six or seven segments, with suctorial discs between the terminal ungues. Larvæ six-legged."

With the exception that they have a third claw in place of an empodium, the Nyasaland mites agree with this definition, while the adults appear to resemble more closely hydrachnidæ.

I have a considerable number of specimens mounted permanently, and shall be pleased to send a selection to anyone who is interested in the subject and would care to have them.

I am indebted to the Principal Medical Officer, Nyasaland Protectorate, for permission to publish this paper.

[We are indebted to Dr. Andrew Balfour for the following observations on this paper.—ED.]

"Captain Dye is to be congratulated on the careful observations he has made upon the mites infesting mosquitoes in Nyasaland. He has, to some extent, extended our knowledge regarding these arthropods, and his drawings appear to be the best illustrations of them which have hitherto appeared in medical literature.

"It may be noted that while the French author Dyé found, as Captain Dye has found, that only female mosquitoes were infested, the Sergents in Algeria observed mites upon male anophelines. Prior to Captain Dye's description, the fullest account of these small water mites was that by Dyé, whose work I mentioned in the paper to which Captain Dye refers. I there stated that Dyé divided them into three types, but that it was unnecessary to quote the details given in his paper. In the light of Captain Dye's observations, however, it may perhaps be well to append the following translation of a small portion of Dyé's paper. This has been kindly extracted for me by Lieutenant-Colonel Stammers, and its perusal would seem to show that the Madagascar mites of the first and second type, described by Dyé, are probably the same species as those to which Captain Dye has directed attention. It is true there are a few small discrepancies, but in the main the accounts agree, although Captain Dye's is much the more elaborate:—

'*First type.* Top view globular in appearance—av. 335 μ long and 330 μ broad; small head, broadened transversely, apparently articulated and capable of movement; 4 eyes, 2 large ones lateral and 2 small ones submedian. Palps large with several (3 or 4) articulations, termination hook-like; on one of the joints is a long transversely placed hair. Buccal orifice apparently formed for suction; mandibles very short and hidden in the buccal orifice with two inferior lips disposed flat on the buccal orifice, which appears to open at the lower part. The 6 epimeres of the 3 pairs of legs distinct, the 2 first small and equal in size, the posterior pair larger, The free legs with five joints, some long hairs on the joints and short spines massive and squat; no swimming hairs. A claw, strong and recurved for each pair of legs with small accessory claws. No visible spiracles, no thickening on the dorsal surface. Colour clear. Interior of body indistinct. No trace of genital apparatus.

'Seen from the side and attached to the mosquito the larva has a less globular appearance, being elongated in the longitudinal direction and measuring 358 μ long and 212 μ across. It appears to hold on to the body of the mosquito by its rostrum. This is firmly fixed in the tissues of the insect, which often tears itself in its endeavour to be rid of the parasites. In this position, at least when preserved in alcohol, the mite has its legs held against its body; they do not appear to come into connection with the body of the mosquito.

'*Second type.* Approaches very closely the former, but is less globular in form, the head is less enlarged transversely and is without the two long hairs. It seems to have a covering which may well be no more than the cast skin (moult) of the transition stage from larva to nymph. This type shows almost constantly a blackish mass in its interior, which may be taken for a first essay at genital apparatus, but which in reality is only the residue of ingested food.

'*Third type.* Seems to be linked up by the largeness of the rostrum with the larva of hydrachna. Only one specimen was seen on a Mansonia.'"

MOSQUITOES IN BERMUDA.

By Major J. Du P. LANGRISHE, D.S.O.
Royal Army Medical Corps.

Introductory.

Since it is only comparatively recently that identification has been made of the various species of mosquitoes existing in Bermuda, and since, further, there does not appear to be any record of them to which reference may readily be made, the following brief notes have been compiled in the hope that not only may they be of interest to officers of the R.A.M.C. in general, but also that easily accessible information may be available for those whose lot it may be in the future to be stationed in Bermuda. No attempt is made to present an exhaustive scientific disquisition on the subject, the end in view being merely to set forth, in as concise and plain terms as possible, only such salient points as appear to be necessary. Thus, the descriptions of the various mosquitoes and their larvæ are far from being complete, those features alone being mentioned which it is essential to consider in distinguishing between the different local species, any further information required by the seeker after knowledge being obtainable in the references quoted.

Public interest in the control of mosquitoes in Bermuda has been greatly stimulated of late owing to several factors, of which the following are the chief: viz., first, the enactment of the local Pest Destruction Act (1921), framed with a view to the prevention, *inter alia*, of mosquitoes; second, the complaints of visitors about the annoyance caused by these insects, and the ill effects which these complaints, repeated at home (United States of America), are likely to produce on the large and growing tourist traffic; third, the greatly increased danger of the introduction of yellow fever, due to the very recent inauguration of a steamship service which forms a close connecting link between British Honduras—an endemic yellow fever area—and Bermuda. What such a visitation has meant in the past is very vividly portrayed in the reports of the Commissioners appointed to inquire into the outbreaks of yellow fever occurring in Bermuda in the years 1853, 1856 and 1864—in the first of these epidemics no less than twenty-four per cent of the garrison and their families succumbing to the disease. In all the evidence given before the Commissioners it is pathetic, in the light of modern knowledge, to note that never once did the humble mosquito come under suspicion—all sorts of vague theories, such as "Miasms," "alterations of electric fluid in the atmosphere," etc., being put forward in explanation of the spread of the disease. One must admit, however, that such a catastrophe is never likely to recur, though it is not improbable that were the disease to be

introduced under existing conditions, there would be several cases before the outbreak was controlled.

Some Preliminary Considerations.

The islands of Bermuda are entirely composed of porous limestone rock, or, more correctly perhaps, of calcareous sand-drift, which is made up of particles of comminuted shells and corals loosely cemented together. Soil is scanty, rarely exceeding two feet in depth, and is itself extremely porous owing to being entirely devoid of clay.

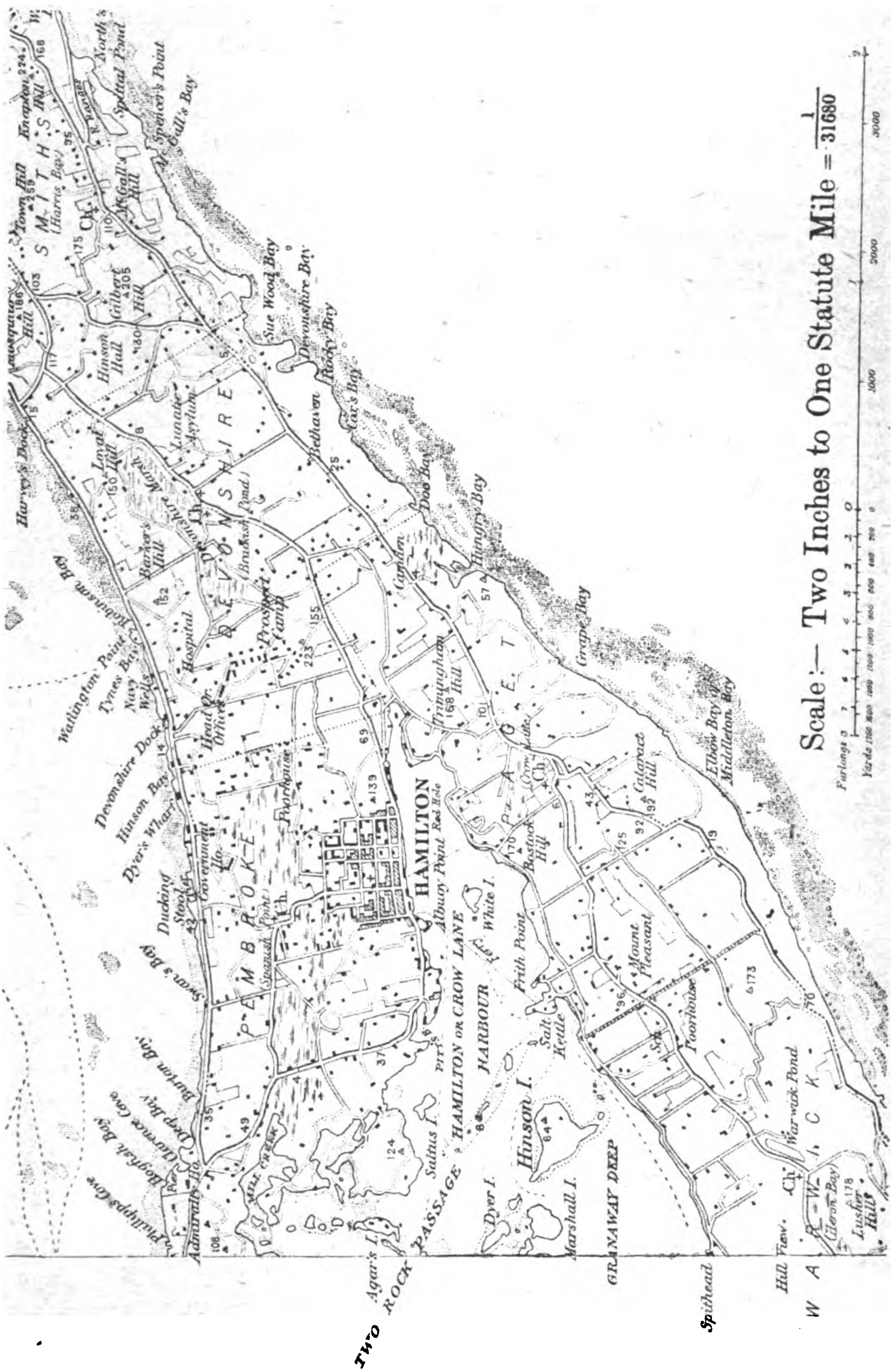
It will thus be seen that the geological formation is against the retention of rain-water on the surface, so that there are no natural collections of fresh water and no streams. The porosity of the rocks is remarkable, being such that the sea-water finds its level throughout the islands from shore to shore. When precipitation occurs, the water rapidly passes through the soil and rocks until it reaches sea level, there to mingle with the infiltrated salt water. In certain parts of the islands, where the ground level is at, or only just above, sea level, there are to be found salt-marshes and brackish swamps, the most important of which are Pembroke Marshes and Devonshire Marsh. The former lie immediately to the North of Hamilton City, and the nearest point of the latter is about a quarter mile distant from the East side of Prospect—the principal War Department area (*vide* Map). The chlorine content of the water in these marshes is, as noted later, very high.

All fresh water for domestic use is obtained from rain-water catchments, either on the roofs of buildings or on specially prepared areas on high ground, and is stored in closed tanks. Every occupied dwelling must, by law, be provided with adequate storage for rain-water, and here we have at once almost innumerable potential breeding-places for mosquitoes. Similarly in War Department areas, the roof of almost every building is utilized as a catchment area from which the water is collected into one or more tanks. In St. George's, water for sanitary purposes in barracks is pumped from a brackish well sunk to sea level: this water contains chlorine to the extent of 190 parts per 100,000.

The method of sewage disposal also has a bearing on mosquito production—less so in the War Department than in the civil areas. In the former all the sewage is disposed of by water-carriage into drainage systems discharging into the sea, though a few cess-pits exist in connexion with certain quarters and buildings where, from the configuration of the ground, it is impossible to discharge into the drainage systems. Amongst the civil community, however, there are practically no such drains, sewage from the better class houses being water-borne to a cess-pit; while for the poorer class of dwellings privy-middens are made to suffice.

There are no definite wet and dry seasons in the islands—rainfall being fairly evenly spread over the year. The months of May, June and July have, on the average, somewhat less precipitation than the remaining

MAP TO SHOW SITUATIONS OF PRINCIPAL MARSHES IN BERMUDA.



months, but this is by no means free from exception. The annual rainfall averaged over a period of thirty-three years, is about 59 inches and may vary from as little as 39 to as much as 90: but these are exceptional figures, the more usual variations lying between 48 and 63 inches. August is one of the wettest months (average 5·6 inches) and being also the warmest, is the most favourable time for mosquito production—a succession of fairly heavy showers every two or three days, maintaining a sufficiency of water for larval development in the many thousands of discarded bottles, "cans," etc., scattered all over the islands.

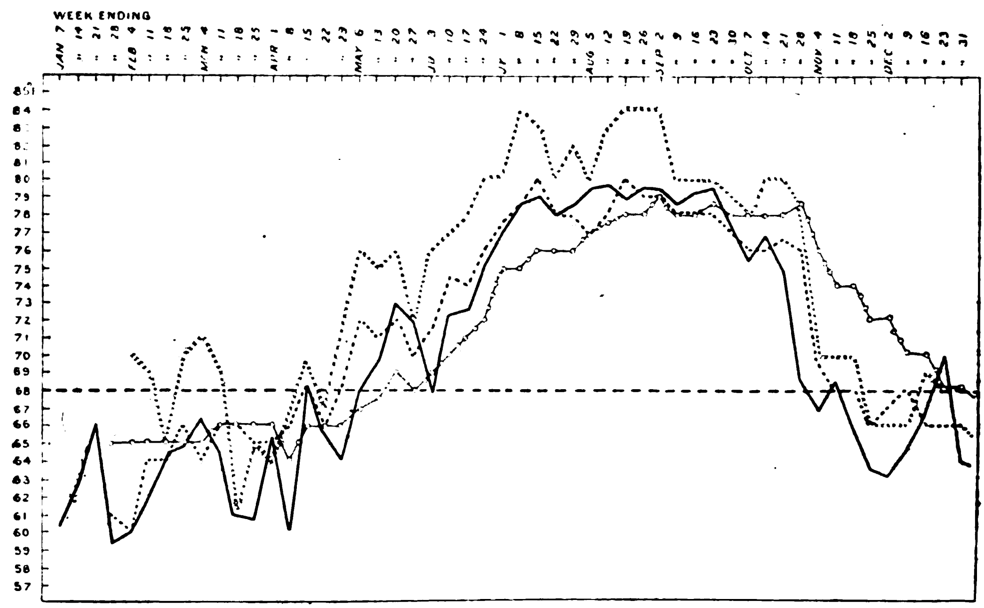


FIG. 1.—Graph to show relationship of water temperature to "mean" air temperature.

———— Weekly mean temperature of the air.
xxxxxxx Temperature of water in large iron tank exposed to sun (concrete top).
—o—o— ,, ,, in underground masonry tank NOT exposed to sun.
. . . . ,, ,, ,, ,, top exposed to sun.
— — — Crucial temperature for larval development.

Temperature, fortunately, is not favourable for either oviposition or development throughout the whole of the year, it being too cold during the months December to March (and usually in November and April as well) [1], [2]. The daily mean air temperature (deduced from twenty-four hourly maximum and minimum shade readings) in the cool months averages round about 62° F., extreme "means" being 55° F., and 68° F., and gradually creeps up during May and June to an average of 79° F., in July, August, September and October. In the latter month it begins to decline—sometimes falling quite suddenly with the advent of cool northerly winds—until,

at the end of the year it is once more about 62° F. The daily range of shade temperature is never great and is usually about 12°—14° F., although slightly greater variations are frequently recorded. The maximum shade temperature has never been known to exceed 90·1° F., while the minimum "in the screen" in the cool months may be as low as 43° F.

Variations in the temperature of the water in tanks follow fairly closely those of the "mean" air temperature, though, of course, lagging somewhat behind. The type and situation of a tank has a marked influence on this, which will be best understood by reference to the graph (fig. 1), on which have been plotted the weekly mean temperatures and weekly thermometric readings of surface-water temperatures in various types of tanks carried out during the year 1922. The majority of tanks are constructed of masonry and are sunk in the ground, the top being composed either of stone, brick or concrete. In some instances they are situated underneath buildings.

The temperature of water in cisterns, placed, as the majority are, on the exterior of buildings varies within wide limits from day to day and even during each twenty-four hour period, depending on the amount of sunshine and the direction of the wind. In the cool months the water temperature in these will drop at night to 60° F. or even lower, and it is not until the month of May is nearly spent that the temperature ceases to fall below the crucial one of 68° F. The importance of this figure lies in the fact that even a temporary lowering of the water temperature below this point will retard not only the hatching of eggs but also the development of larvæ of *Stegomyia fasciata* [3].

Atmospheric humidity is always high, the relative humidity exceeding eighty per cent as a rule, especially during the hot months when the prevailing wind is from the south or south-west, a warm, moisture-laden air-current from the Caribbean Sea, which renders existence particularly trying to the European.

From the foregoing remarks it will be apparent that during at least seven months of the year very favourable conditions exist for the propagation of certain species of mosquitoes. Even during the colder months larvæ and pupæ can occasionally be found in suitable sheltered places where they may exist for many weeks before hatching out.

Species of Mosquitoes.

It should be stated at the outset that the nomenclature followed here is that most recently in use, the more common synonym or synonyms, where existing, being enclosed in brackets.

There are, then, so far as is known at present, four species, all of the tribe Culicini, and they fall into two groups, based on the nature of their breeding habits as follows :—

Domestic Breeders.

(1) *Culex fatigans* (*Culex quinque fasciatus*), 4, 5, 6.

(2) *Aëdes argenteus* (*Stegomyia fasciata, Aëdes calopus, A. ægypti*), 6, 7, 8, 9.

Salt-marsh Breeders.

(1) *Aëdes sollicitans*, 6, 10.
(2) *Aëdes tæniorhynchus*, 6, 11.

Culex fatigans.—This, the common house mosquito of most tropical and subtropical regions, requires no special description. It will be sufficient to

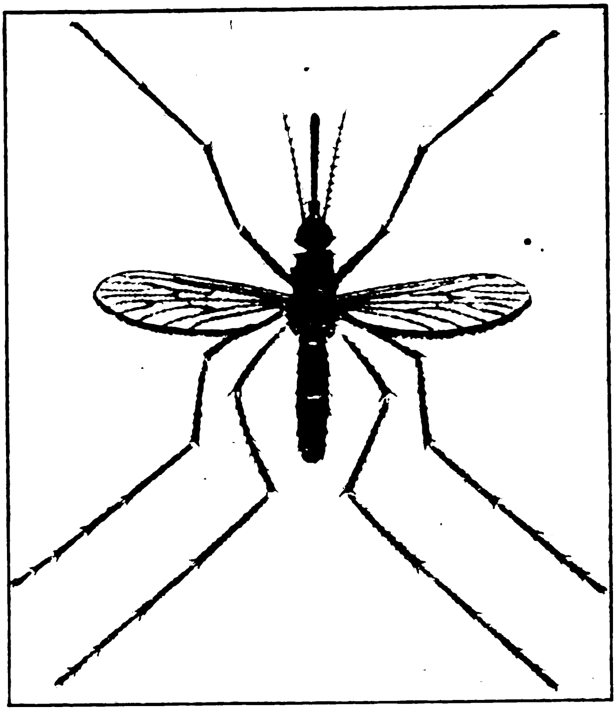


Fig. 2.—Adult female *Culex fatigans*.

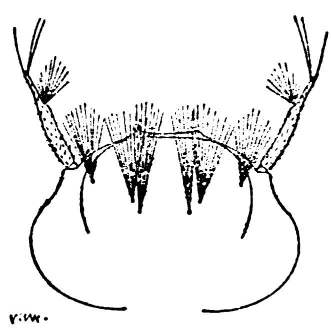


Fig. 3.—Head of larva of *C. fatigans*. (After Komp.)

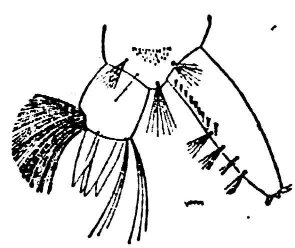


Fig. 4.—Eighth and ninth segments and breathing tube of larva of *C. fatigans*. (After Komp.)

note that in the adult (fig. 2) the proboscis and legs are of a uniform dark brown colour not ringed or spotted in any way. The thorax is of a reddish-brown or tawny colour. The abdomen is dark-brown with narrow bands

of yellowish or dirty-white scales at the bases of the segments. The larva (figs. 3, 4) is easily distinguished from those of the other local species by reason of the much greater length of its syphon or breathing tube, which is at least four times longer than broad, and by the multiple dorsal head hairs.

This mosquito will breed in any collection of non-brackish water—indeed its tastes seem to be rather low, for it prefers foul water to clean, and its larvæ have been found even in liquid manure and in cess-pits. To

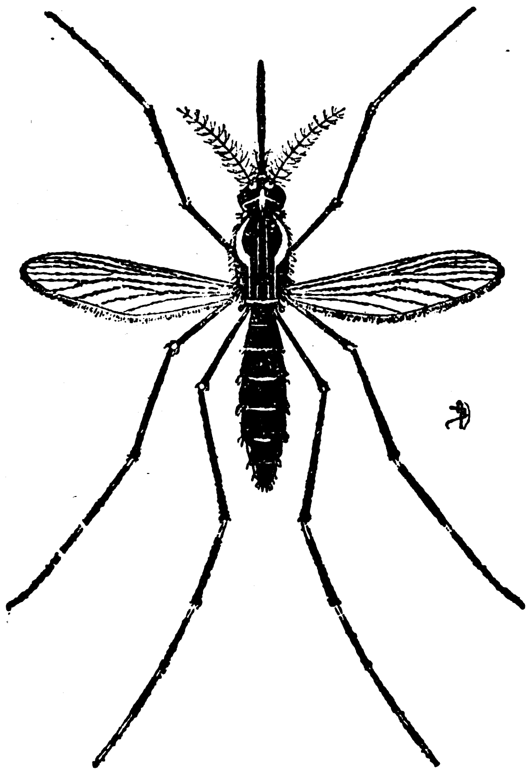


FIG. 5.—Adult female *Aëdes argenteus*, the yellow fever mosquito. (After Howard.)

quote from a recent American publication [12]: "It may be considered axiomatic that where large numbers of *Culex*, including males, are found in outhouses and barns in any locality under control, some sewage-contaminated breeding-place, cess-pool, catch-basin or sewer exists undiscovered in the near vicinity. Its breeding places are always close to an inhabited building, and during a search no object containing water, or likely to contain water, should be passed by. One may mention tanks, cisterns, sagging or blocked eaves-gutters, gully-traps, soak-pits, cess-pits,

metal wheelbarrows, old bottles and tins, etc., flower vases, ice-chest drip-pans, ant-guards and disused w.c.'s.

Larvæ first make their appearance towards the end of April, or in the early part of May—depending on climatic conditions—and breeding goes on without natural interruption until November.

The adult is most active at night, but will also bite during daylight if a favourable victim offers. At rest it may be found on the walls of rooms, sides of wardrobes, etc., having a predilection for dark-coloured objects (especially dark blue)—a point common to mosquitoes in general. It also frequents stables, fowl-houses, and such-like places, where it has easy access to a blood feed.

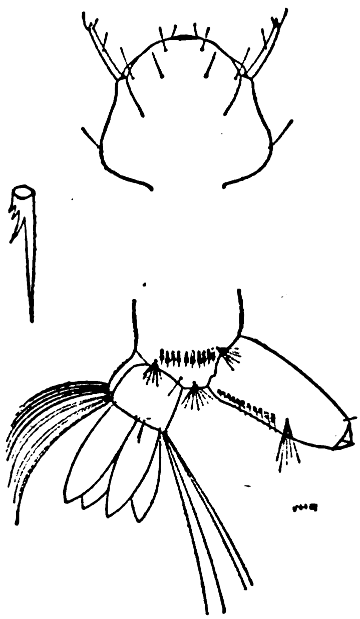


Fig. 6.—Parts of larva of *A. argenteus*. Above—head: left, spine of breathing tube; right, scale of eighth abdominal segment. Below—eighth and ninth segments and breathing tube. (After Komp.)

Aëdes argenteus.—This, the vector of yellow fever and of dengue, is, on that account, the most important of the local mosquitoes, but its characteristic features being so well known, no special description is needed here.

In order, however, to distinguish the adult (fig. 5) from the two other species of *aëdes*, one of which sometimes resembles it, we should note particularly the lyre-shaped marking on the thorax, and the patches of bright silvery scales underneath the wings. At the same time we should observe that the proboscis is *not* marked or ringed in any way. The larva (fig. 6) also is rather similar to those of the other *Aëdes* species, having a short, somewhat barrel-shaped syphon, but is easily distinguished under

the microscope, or with the aid of a good pocket-lens, by the fact that the lateral scales on either side of the eighth abdominal segment are only ten in number and are arranged in a single transverse row, and that the mid-antennal hair-tuft consists of a single hair about half way up.

The adult female attacks man chiefly by day, but is most active at sunrise and sunset. It will not venture forth into bright sunlight—which is fatal to it—but bites actively indoors, and in shady places out of doors. It rests in sheltered places in the open but prefers to haunt occupied buildings, hiding amongst clothing and other dark objects.

Breeding always takes place in close proximity to, or actually inside, buildings, the reason being that the female prefers human to any other blood; consequently it is always in the immediate neighbourhood of occupied quarters and buildings that search must be made for breeding-places. It has this great distinction from *C. fatigans*—it will only breed in *clean*, fresh or slightly-brackish water. Ova are, for preference, deposited either on the sides of vessels, etc., close to water, or in places where collections of water are liable to form [13], though ovipositing has been seen taking place directly on a water surface. It is said that eggs will survive in the dry state for many months, often remaining dormant throughout a cold season and even until a second year [14], [15].

The breeding season usually begins about the middle of May—somewhat later than in the case of *C. fatigans*—and lasts until late October or early November. The variety of places where larvæ may be found is extraordinary—any collection of clean water either indoors or outdoors, being a possible breeding-place. To illustrate this, it may be instanced that on one occasion when some quarters were suddenly invaded by a number of this species, prolonged search eventually revealed their origin to be in a small rowing-boat which had been beached in a secluded corner near-by and contained a quantity of rain-water. Larvæ are rarely found at a greater distance than 200 yards from any dwelling, adults not being of a roaming nature and usually remaining on the premises adjoining their breeding-place. This mosquito breeds freely—if permitted—in the brackish sanitary water in St. George's.

Much interesting information regarding habits of this species and the influence of climate upon reproduction may be found in "The Mosquitoes of North and Central America and the West Indies" (Howard, Dyar and Knab).

Aëdes sollicitans.—This is a fairly large mosquito of a general golden-brown colour (fig. 7). The proboscis is black, and in the female is marked by a broad white band somewhat beyond the middle, a characteristic which, however, is absent in the male. The thorax is densely clothed with golden-brown scales. Each abdominal segment carries dorsally a broad transverse basal band of pale yellowish-white scales and is crossed longitudinally by a broad band of similar scales extending down the middle. The extreme tips of the femora are white: the tibiæ have a very narrow white basal

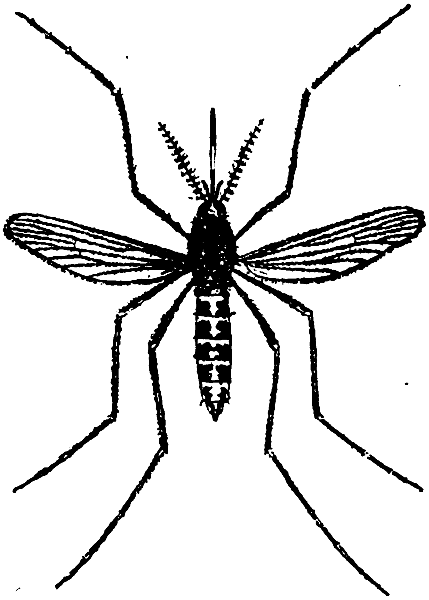


FIG. 7.—Adult female *Aëdes sollicitans.* (After J. B. Smith.)

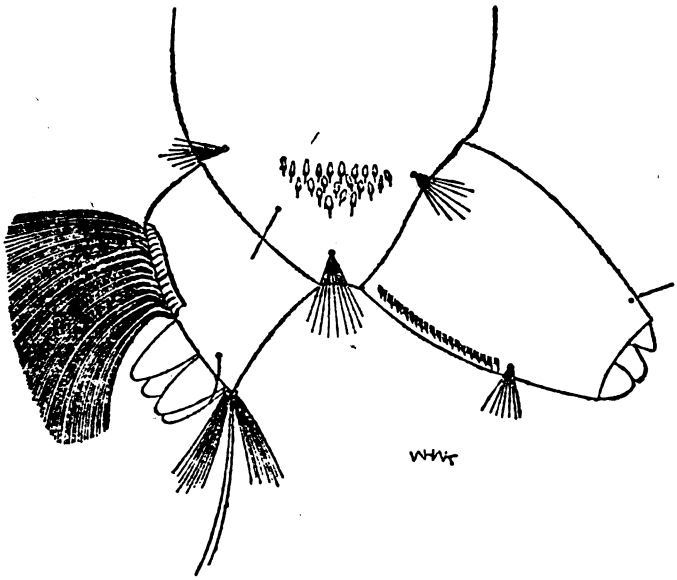


FIG. 8.—Eighth and ninth segments and breathing tube of larva of *A. sollicitans.* (After Komp.)

spot: the tarsi are black, each segment of the hind tarsi having a very broad pure white ring at its base, while the last segment is entirely white. On the front and middle legs the first three tarsal segments are white-marked at the base: the last two segments of the front tarsi are wholly black, but the last tarsal segment of the mid-leg is nearly wholly white.

In the larva (fig. 8) the distinguishing points to note are: the mid-antennal tuft is short and consists of a few hairs; the syphon is not more than twice as long as broad, with a row of scales reaching over half way: the scale-patch on each side of the eighth abdominal segment is of twenty

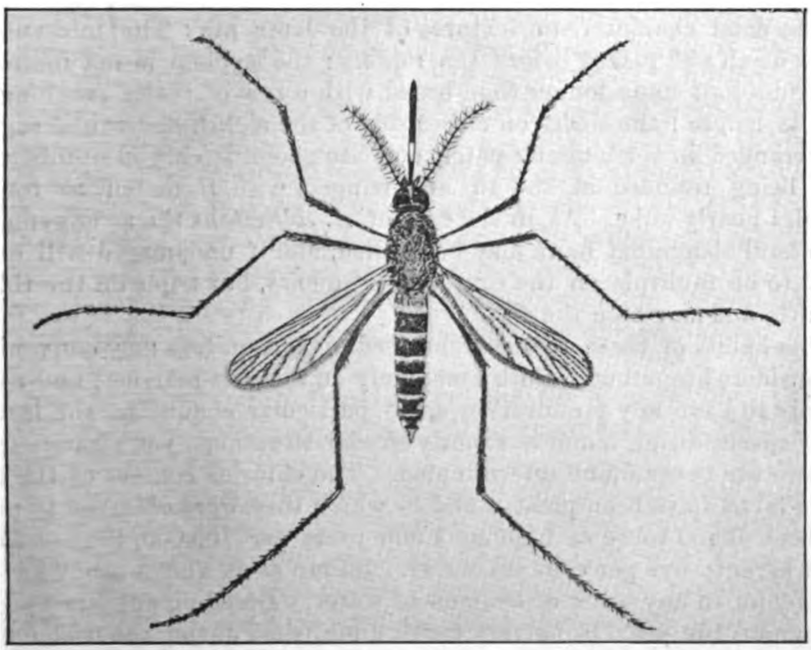


FIG. 9.—Adult female *Aëdes tæniorhynchus*. (After J. B. Smith.)

to forty scales arranged in a triangular patch, the single scale being elliptical with a sharp terminal spine and its sides fringed with smaller spinules. Another feature which may be looked for is the arrangement of the lateral abdominal hairs: unless, however, great care is taken in mounting the specimen for examination some of these hairs may become detached and so lead to inconclusive results if relied on alone for the purpose of identification: they are multiple on the first two segments and double on the third to the sixth segments [16].

Aëdes tæniorhynchus.—The adult of this species (fig. 9) is, at a casual glance, very likely to be mistaken for Stegomyia, but the following brief description will serve to render the distinction easy.

In the adult, which is small, the general colour is black or dark brown; the proboscis is black with a narrow white ring at or before the middle: the thorax is thickly clothed with narrow curved, dark golden-brown scales. Each abdominal segment has a narrow basal band of yellowish-white scales. The femora are generally black, the tibiæ are black with a few spots of yellow scales on the outer sides, while the underside is pale-yellowish scaled. Of the hind tarsi, each segment, except the last, is black with a rather broad white basal ring, the last segment being wholly white: the tarsi of the fore and mid-legs are also black with narrow white basal rings on the first three segments, but the last two segments are wholly black.

The chief characteristic features of the larva are: The mid-antennal tuft is small and placed before the middle: the syphon is not more than one-and-a-half times longer than broad with a row of scales reaching only half its length: the scales on either side of the eighth abdominal segment are arranged in a triangular patch and are about twenty in number, each scale being rounded at the tip and fringed with from ten to fourteen spinules nearly alike. As in the case of *A. sollicitans* the arrangement of the lateral abdominal hairs may be studied, and if undamaged will also be found to be multiple on the first two segments, but triple on the third to the fifth, and single on the sixth.

The habits of these two marsh-breeding mosquitoes may conveniently be considered together. Both breed only in the salt-marshes, and neither appears to have any predilection as to particular conditions, the larvæ of either species being found in exactly similar situations, yet, strange to say, the two are never found intermingled. The chlorine content of the water where larvæ have been present and in which they were observed to pupate has been found to be as high as 1,500 parts per 100,000, that is to say, about seventy-five per cent sea-water. So far as is known, they have not been found in any other collections of water. Breeding appears to go on throughout the year, being very much diminished during the cool months.

The adults are very migratory. *A. tæniorhynchus* has been found locally as far as one-and-a-half miles distant from the nearest known breeding place. Apropos of this it is stated [17] that *A. sollicitans* will travel forty miles, and, aided by light warm moist winds, may fly as far as seventy-five miles. It is also said that *A. tæniorhynchus* will fly equally far. Both of these mosquitoes are voracious biters, *A. sollicitans*, which bites by day usually, even venturing out in strong sunlight at midday to attack its victim. This latter species usually remains out of doors, taking shelter in bushes, long grass and rank vegetation, and is rarely found inside a building. *Aëdes tæniorhynchus*, on the other hand, is a frequenter of dwellings, as it prefers to go indoors in search of its necessary feed of blood. On one occasion it was present in large numbers in the guard room at Prospect Barracks, where it was identified when a search was being made on account of complaint of the annoyance caused by mosquito bites. Its activities

are usually confined to the hours of darkness, but it also makes its presence felt in shady places out of doors in the evening.

It is only during the warm months that these are found at any distance from their breeding haunts, the probable explanation being that the winter gales kill them off if they attempt to leave the shelter of the marshes.

Fortunately neither of these species is concerned in the propagation of any epidemic condition, their presence being undesirable solely on account of the annoyance which they cause.

PREVENTIVE MEASURES.

Domestic-breeding Mosquitoes.—Until quite recently little organized effort appears to have been made by either civil or military authority towards mosquito prevention. On War Department ground, units were—and are still—responsible for the general cleanliness of certain specified areas, and the Royal Engineers were entrusted with the duty of fortnightly oiling of tanks from April to November, and monthly during the remaining months. Lessees of War Department premises are required, in accordance with the terms of their letting agreements, to oil tanks once a fortnight, and to keep in repair, *inter alia,* eaves, gutters, etc. It might be observed, however, that there is no penalty enforceable for failure to comply with these conditions, except the rather drastic one of termination of the letting.

In 1922 there came into force throughout the whole of the islands a local Act—the Pest Destruction Act (1921)—which contains the following pertinent subsection:—

"The presence on any premises of live mosquito larvæ shall render the occupier, or in case of unoccupied premises, the owner, liable to conviction for a breach of the By-laws," which are as follows:—

"(1) No owner or occupier shall permit to remain on his premises any collection of water capable of breeding mosquitoes unless such collection of water is rendered incapable of mosquito production by: (*a*) Screening with wire gauze of not less than eighteen meshes to the inch, or otherwise effectively covering to the satisfaction of the General Board of Health; (*b*) periodical treatment with kerosene oil or other larvicide approved by the General Board of Health; (*c*) introduction of larvæ-eating fish in sufficient numbers to prevent the presence of mosquito larvæ. Any receptacle likely to catch or contain water which cannot be dealt with as prescribed in (*a*), (*b*) or (*c*) shall be emptied and dried at least once in every five days.

"(2) The owner or occupier shall cause to be filled up or drained any pools, hollows in trees or rock cisterns which cannot be dealt with as specified in Section 1.

"(3) The owner or occupier shall not permit to remain on his premises any rain-water pipe, gutter, roofing surface, or tank-tops so constructed as to admit of water collecting and remaining therein or thereon."

Section 4 of these By-laws provides for the issue of permits to breed mosquitoes for scientific purposes, and Section 5 lays down the scale of fines to be imposed in cases of conviction for breaches of the By-laws.

Under the powers conferred by this Act, Sanitary Inspectors of the Colonial Public Health Department make periodical inspections of the area administered by the civil authority, and bring delinquents before the local justices. In order to comply with the provisions of the Act, and at the same time to put into operation effectual measures for mosquito prevention in barracks, a scheme was formulated and put into action without delay.

The Command is divided into three sections for all administrative purposes, viz. :—

No. 1 section, St. George's Barracks and War Department area in the vicinity.

No. 2 section, Prospect and Hamilton City.

No. 3 section, which is of much smaller extent than the others, includes Boaz and Watford Islands and portion of Ireland Island.

A "Mosquito Brigade" under a combatant officer, is organized separately for No. 1 section, and another of similar composition for No. 2 section, which is, at the same time, responsible for antimosquito work in No. 3 section, travelling to and fro by W.D. steam launch once a fortnight for the purpose. Each section is divided up into areas, with the exception of No. 3 which is sufficiently small to be dealt with as one area, and a definite programme of work is arranged and published in Command Orders with the object of ensuring that each area is thoroughly dealt with once a fortnight. The period of active operations begins in the middle of April and extends to the end of November.

The duties of the Mosquito Brigades are, briefly, as follows :—

(1) To search thoroughly for all possible breeding-places, e.g., any casual receptacle which may hold water, and, when found, to deal with them in the manner best suited to each ; (2) to oil once a fortnight with "light fuel oil" all tanks and cisterns which either are not mosquito-proof or have not been stocked with fish, and to deal similarly with rain-water gully-traps, yard traps, soak-pits and grit-sumps ; (3) to report structural defects, e.g., sagging eaves-gutters, for repair ; (4) to compile a daily report on a special form, of the area dealt with each day, with the findings and action taken, which report, after extraction of the necessary records by the O.C. Mosquito Brigade, is forwarded by the O.C. Section, through the officer in medical charge, to the D.A.D.H. of the Command. One day a week is set apart for such work as re-stocking tanks with fish and for clearing of rank vegetation and undergrowth. For the latter purpose the mosquito brigade is augmented by fatigue-parties provided with the necessary implements.

Each O.C. Mosquito Brigade is provided with a large-scale map of his section showing the situation of all water-tanks, and keeps a book contain-

ing a detailed record of such tanks, cisterns, gully-traps, soak-pits, etc., in the section for which he is responsible.

No tank or cistern is regarded as being mosquito-proof if there exists any possible means of ingress or egress for a mosquito and unless repeated observation has proved the absence of larvæ during the breeding season. Ventilators of tanks are at present screened with wire-gauze, but the mesh is sufficiently large to permit of the passage of *Aëdes argenteus* (*Stegomyia fasciata*), being only fourteen meshes to the linear inch [18], [19]. Such tanks are *not* regarded as being mosquito-proof and are dealt with accordingly, while action has been taken with a view to having substituted a screening of not less than seventeen meshes to the inch. Again, many tanks are provided with wooden inspection doors or covers, which, if not damaged in some way, are frequently either so rotted, shrunken or warped as to leave an easy passage for mosquitoes.

Much difficulty is experienced with cisterns; most of these are provided with a metal cover which seldom fits sufficiently close to render them mosquito-proof. The reason for this is principally the manner in which supply pipes are led into the cisterns by arching over the top edge, thus rendering it almost impossible to make the cover close-fitting; further, the violent winter gales sometimes partially lift the cover owing to the exposed position of the cistern.

Mention has been made above of the use of fish in tanks and cisterns. In the month of March this year (1923) non-mosquito-proof tanks and cisterns were stocked with gold fish which the Medical Officer of Health (Dr. E. Walker) very kindly supplied gratis, it being hoped by this means to reduce very greatly the expenditure of labour and oil in treating the very large number of tanks and cisterns existing throughout the Command. It was soon discovered, however, that gold-fish would not survive the high temperature which water attains in exposed cisterns during the summer, reaching as it does 100° F. in many instances. Recourse then had to be made to oiling those cisterns from which gold-fish had disappeared, thus greatly increasing the labours of the mosquito brigades. The idea then presenting itself of substituting a local species of Mullet or Mangrove minnow (*Fundulus bermudæ*, Gunther, *F. rhizophoræ*, Goode), which flourishes in the brackish ponds and marshes and being a top-feeder is a good larva-eater. This fish can be readily and rapidly acclimatized to a life in fresh water, and accordingly trial is being made of it in some cisterns —so far with complete success. Another difficulty was experienced with gold-fish in that they very soon died when placed in the slightly brackish water used for sanitary purposes in St. George's; mullet were thereupon substituted for these with entirely satisfactory results.

On one occasion it was reported that larvæ were present in large numbers in a sanitary water cistern at St. George's, despite the fact that it contained several active mullet. Investigation showed that the sides of the cistern were coated with a felted mass of growth and it is probable that

the fish preferred this to the more elusive larvæ, for after the cistern was thoroughly cleaned out no more larvæ were to be found. The moral of this is, keep the tanks and cisterns clean and free from algæ.

Marsh-breeding Mosquitoes.—The marshes being outside War Department areas are not included in the spheres of duty of the mosquito brigades and such anti-mosquito measures as are carried out there are the work of the Public Health Department.

At present operations are confined to the Pembroke Marshes on account of the great nuisance caused by the mosquitoes in the City of Hamilton and in the hotels and numerous private residences in the neighbourhood. Spraying the surface of the water with a heavy grade of kerosene is methodically performed and sides of drainage channels are kept cleaned, under the supervision of the chief sanitary inspector. Judging by the much reduced prevalence of these mosquitoes at the present time as compared with previous years, the measure is meeting with a large amount of success.

These marshes lie at sea level so that effective drainage is impossible. Pembroke Marsh is connected with the sea by means of a small channel or canal which is guarded at its outfall by a "non-return" flap valve permitting the water to pass outwards only. Despite the presence of this valve there is a certain amount of rise and fall in the water-level, varying with the tides, in the more open parts of the marsh; these areas are stocked with mullet which breed therein to an enormous extent and are most efficacious in keeping down the larvæ. Portions of the Pembroke Marshes have been reclaimed here and there by "dumping" and this process is still going on, but only on a small scale, the material used being town refuse. A proposal has recently been put forward, however, at the instigation of His Excellency the Governor, Lieutenant-General Sir J. J. Asser, K.C.M.G., K.C.V.O., C.B., to push on the process of reclamation with a view to converting the Pembroke Marshes into a public park, with polo grounds, etc.—a wise and far-seeing scheme which will not only benefit the community by the abolition of these mosquitoes, but, further, should eventually provide a most attractive addition to the amenities of the islands.

Devonshire Marsh (to the east of Prospect) is included in this scheme, the land so reclaimed is to be cultivated or, possibly, it is suggested, utilized for an extension of the adjoining golf links. This marsh differs from Pembroke Marshes in that it has no outlet, being completely surrounded by high ground (*vide* Map).

This proposal to reclaim the marshes is, however, no new one. As far back as 1857 one of the witnesses who gave evidence before the Commission of Enquiry into the Yellow Fever outbreak of 1856, put forward a plea that this should be done in order to eliminate the "noxious effluvia" and "malarial miasmeta" arising from the marshes. In such a small community as Bermuda, with a total population of only 22,000 all told, a large

undertaking of this nature requires careful consideration and has hitherto been found impracticable on account of the great expense that would be incurred in carrying it out.

Conclusion.

I desire to express my gratitude to Dr. E. Walker, Medical Officer of Health, Bermuda, for much valuable information and assistance so kindly furnished by him; also to the chief Sanitary Inspector, Mr. Evans, who has ever been ready to demonstrate operations carried out in the marshes; and for material supplied by him. Acknowledgments are due to the McGraw-Hill Book Company, 370, Seventh Avenue, New York, for permission to reproduce figs. 2, 7 and 9; and to the Superintendent of Government Printing, Washington, for a similar courtesy with regard to figs. 3, 4, 5, 6 and 8.

KEY FOR DETERMINING SPECIES OF FEMALE ADULT MOSQUITOES.

1	Legs banded or marked with white	= 2.
	Legs unbanded, uniform in colour	= *Culex fatigans.*
2	Proboscis centrally ringed with white. Thorax without any white markings on back	= 3.
	Proboscis unbanded. Thorax marked with lyre-shaped design in white	= *Aëdes argenteus* (= *S. fasciata*).
3	Abdomen with dorsal longitudinal whitish stripe, white band on proboscis broad and beyond middle	= *Aëdes sollicitans.*
	Abdomen not so striped, white band on proboscis narrow and at or before middle	= *Aëdes tæniorhynchus.*

KEY FOR DETERMINING SPECIES OF LARVÆ.

1	Syphon much more than twice as long as broad; dorsal head hair multiple	= *Culex fatigans.*
	Syphon not more than twice as long as broad; dorsal head hairs single	= 2.
2	Scales on eighth abdominal segment arranged in a single row	= *Aëdes argenteus.*
	Scales on eighth abdominal segment arranged in a triangular patch	= 3.
3	Syphon more than one and a half times as long as wide; with pecten of scales reaching more than half way; individual scales on eighth abdominal segment with long terminal spine	= *Aëdes sollicitans.*
	Syphon not more than one and a half times as long as wide, with pecten of scales reaching to half way; individual scales on eighth abdominal segment rounded at tip and fringed with spinules of equal size	= *Aëdes tæniorhynchus.*

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ON THE MODES OF PRODUCTION OF "RICKETTSIA"-BODIES IN THE LOUSE.

By H. M. WOODCOCK, D.Sc.Lond.
Fellow of University College.

HAVING now had an opportunity of examining "Rickettsia"-bodies as they are to be found in the body-louse (*Pediculus humanus* = *P. vestimenti*), it may be useful to supplement my recently published account of these elements [16].

The material has been obtained from two sources. In the first place, Professor E. Brumpt, of the Faculté de Médecine, Paris, has most courteously placed at my disposal a preparation of his, comprising smears from eight lice taken from German prisoners of war who had been interned in France for several months. These were made during the course of Brumpt's own investigation, the results of which he has described [5]. Secondly, I have examined numerous smears of the excreta of normal lice, of more than one generation, which were fed on myself for a period of over a month. These lice were taken from verminous, but otherwise healthy, children at an East London school disinfesting station; and I desire to thank Dr. Wenyon, for informing me of this particular supply, and the Sister in charge, for her assistance in obtaining the lice.

I gather from Brumpt's account that he used the May-Grünwald and Giemsa stains, following the panoptic method of Pappenheim. My own smears were all stained by Giemsa in the usual manner. With fresh material, there was no difficulty in staining the "Rickettsia"-bodies by using the short method, namely two to three drops of the stain per cubic centimetre, for half-an-hour, which was also used for the "Rickettsias" previously described.[1] I am indebted to Mr. A. Dennis for kindly taking the photomicrographs, the magnification of which is, throughout, 1,000 diameters, with the exception of fig. 16 which is × 2,000.[2]

It will be best, I think, to consider Brumpt's lice and my own

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[1] Wolbach, Todd and Palfrey [13] also found there was no difficulty in staining *R. prowazeki* by using a more dilute solution (one drop to the cubic centimetre) for a longer period (three to four hours).

[2] On account of the great cost of the figures, unfortunately, not all the photos which were taken for purposes of illustration can be reproduced. I hope it will be borne in mind throughout that the conditions and stages described could have been much more amply illustrated had circumstances permitted. As it is, my share in the expenses of illustration has had to be met with the aid of a portion of a grant from the Thomas Smythe Hughes Medical Research Fund, which has been most kindly awarded me by the University of London to continue my study of hæmataboly.

separately, because the condition found in the two cases differs; that in the former is certainly, I think, pathological as regards the louse, in the sense that it is abnormal and harmful.

THE "RICKETTSIA"-BODIES FOUND IN BRUMPT'S LICE.

At the time of his original description, Brumpt regarded the forms he observed as representing *R. prowazeki*, but in a letter he informs me that he has since changed his opinion and now considers that they indicate *R. pediculi*, the non-pathogenic type. In arriving at this conclusion Brumpt is doubtless bearing in mind the fact that he allowed seventy-two of his lice, of which more than fifty were infected, to feed on himself two or three times, without detrimental effects. The weight of this evidence, however, is not, perhaps, so great as might be at first thought. Because it has been shown, in connexion with trench fever, that infection results, at any rate in the great majority of cases, from contamination of the excoriated skin, or it may be, even the bite-puncture, with the excreta—and not from the bite itself (cf. Bruce [4] and Byam with others, "Trench-fever" [6]). Moreover, in the ordinary course, many successive feedings are often necessary before infection occurs. It is difficult to be certain, therefore, from Brumpt's statement, whether his experiments really satisfied the conditions requisite for success. It is agreed that, from the attendant circumstances, there is not the slightest reason to think that his lice had been infected with the virus of typhus: but, on the above ground alone, a doubt might remain whether they had not possibly been infected from old trench-fever patients, in which case the forms occurring would be those of *R. quintana*.

For another reason, however, I think Brumpt was dealing neither with trench-fever forms, nor with those which are to be found normally in healthy lice (*R. pediculi*). The general picture to be seen in his smears shows such a variety of forms, including intracellular "phases," that the condition is much more comparable to that associated with *R. prowazeki* or *R. rocha-limæ*. And as the former can be eliminated, it follows that the bodies present apparently indicate the latter condition.

But in this connexion there is quite another consideration to bear in mind. Nöller himself has recently [11], and I consider with much truth, questioned the reality of morphological "specific" differences among the principal louse types; I agree with him—especially as regards *pediculi* and *quintana*, on the one hand, and *rocha-limæ* and *prowazeki*, on the other. A similar uncertainty is apparent also in Mello's note [9] (cf. the reference I made to it in my own paper, p. 260). Now this point is of great importance in relation to the question of the mode of origin of all these bodies; since it will be evident that, regarded merely as ultimate products of the digestion or lysis of organized elements, there is no reason to expect the same distinctiveness of morphological characteristics, which, in respect

of one feature or another, we should look for in different species of living organisms. Variations of either size or form are of much less significance in the case of residual end-products than in the case of an organism. On the other hand, we may expect to find, at times, or in certain conditions, (quite similar products (that is to say, so far as their morphology is concerned) resulting from the action of different enzymes, on a particular kind of material. As an instance I may refer to the Negri-bodies and the Guarnieri-bodies, certain types of which, complex as they appear, closely resemble each other microscopically, different though the pathogenic enzyme is, which is associated with the pathological hæmetaboly in the two cases.

The extremely varied forms of "Rickettsia" met with in the louse have been often described by many workers so that I think it preferable here to consider how such bodies—or at any rate bodies so similar that I cannot distinguish the alleged organisms therefrom—may be produced. They can be formed along the two main lines I have previously indicated, namely as a result of (*a*) abnormal digestion of the blood, and (*b*) cell-lysis, especially karyolysis, a process which can be regarded as a form of auto-digestion.

(A) Abnormal Digestion of the Hæmoglobin.

A large proportion if not the great majority of the extracellular bodies, i.e., those occurring "free" in the lumen of the gut, are most probably formed in this manner; especially in the case of those types (*pediculi* and *quintana*), which are not found, or at least very rarely, in an intracellular situation.

In the gut-contents and also in the excreta,[1] the undissolved hæmoglobin in course of alteration and digestion appears in two forms. In the first places, masses and grains of black pigmentiferous material occur, of very varying size (figs. 1, 2, cf. also fig. 21 from a normal louse). The larger masses are irregular and amorphous in appearance, but the small grains and granules are definitely spherical in outline. I think the former represent an early digestive change in the hæmatogenous material following upon a cohesion and consolidation of the corpuscular substance. The latter certainly result from the gradual break-up and repeated fragmentation (in a mechanical sense) of the larger masses. Many of these have a lobulated appearance, the next stage being an aggregation of spherules, themselves often unequal in size; these become later separated and dispersed. Not infrequently a grain is markedly diplococcal in form before the two halves have become completely divided (cf. fig. 15*d*).

[1] It will be remembered that associated with the intake of the blood and the mechanical movements of the alimentary tract, the blood undergoes considerable churning in the louse; hence even in the terminal portions of the gut and passed out with the fæces, blood is in various stages of digestion including some but slightly altered.

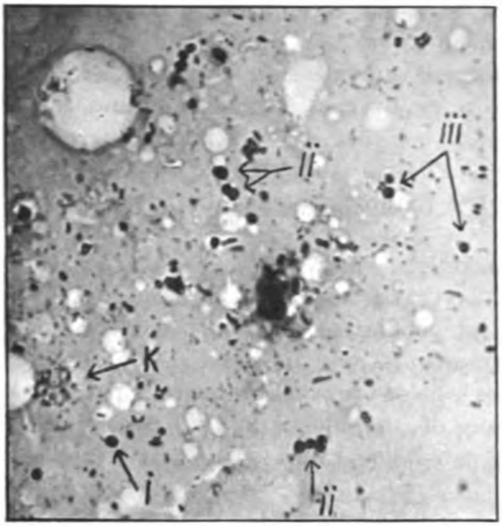


Fig. 1.

Fig. 2.

Fig. 3.

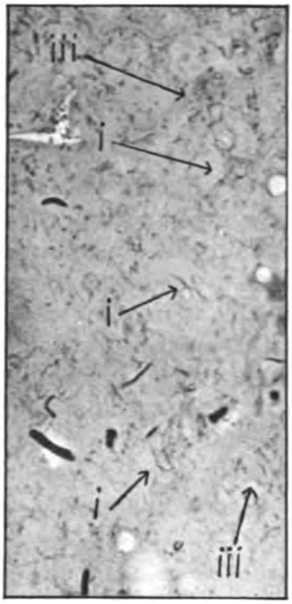


Fig. 4.

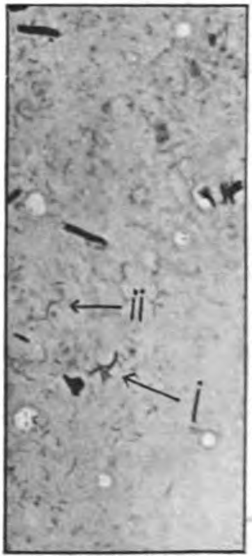


Fig. 5.

On the other hand this pigmentiferous material may have the form of elongated rods and rodlets, of all sizes (figs. 4, 5, and again, 17-19, 23 from normal louse-excreta). Many of these have the sharp, angular outline of actual crystals; but others are frequently slightly bent or irregularly curved. Another type of form seen is that of delicate, curved or wavy streaks or threads, long or short (cf. fig. 3). Unlike the spherical masses the colour of this second type of hæmatogenous material may be either black, or it may be brown to brownish-yellow, especially in the case of the smallest and finest. By the application of Brown's modification of the test for iron,[1] it is seen conclusively that all this pigmentiferous material *contains the iron of the hæmoglobin*, a most instructive point.

Both the above described varieties of residual product of the digested hæmoglobin are to be found side by side in smears of the gut contents or of the excreta; sometimes one kind predominates, sometimes the other. I am unable to say whether the spherical masses may ultimately become rod-like in form though I think this is possible, and that the more crystalline, brownish-yellow grains represent the final stage of alteration after all the assimilable proteid material has been removed and absorbed.

Considering all these forms of pigment-grains, the thought inevitably strikes one how bacteriomorphic most of them are! If they were not manifestly pigmentiferous material, from their colour, *but happened instead to stain with Giemsa*, we should not be able to say from their appearance that we were not dealing with various types of bacteria—coccoid, diplococcoid bacillary or even spirillar, as the case might be. Cowdry has himself pointed out [7] the undeniable resemblance between such pigment-granules of hæmatogenous origin and "Rickettsias," but was unfortunately not able to trace any relationship between the two things. In Brumpt's smears however, ample evidence of the transformation from such grains into Giemsa-staining "Rickettsia"-bodies is, I consider, forthcoming.

In figs. 1 and 2 are shown a number of transitional stages in this most interesting and pathologically important change. The references i, ii and iii are used to indicate gradations in colour of the little masses as follows: (i) jet-black, both by daylight and artificial illumination; (ii) black by daylight, but with the merest shade of purple in the black or else appearing a very dark purple by artificial light; (iii) purple or strong lilac by either illumination; and lastly, lilac to reddish lilac, in the case of the smallest spherules. Finally we arrive at the minute, reddish-lilac granules,

[1] I have found the following to be the best way of performing the test. The smear after fixation with alcohol in the usual manner is placed for a quarter to half an hour in Merck's "perhydrol," diluted with twice the amount of distilled water. It is then rinsed and placed in the ferrocyanide-dil. HCl mixture for five minutes. The strength of the HCl should not exceed one per cent, otherwise the iron, which seems to be in rather loose organic combination is all set free and dissipated into the immediate neighbourhood. The smear is ultimately well rinsed. By this method the blue-coloured pigment-grains stand out remarkably sharp and precise.

the typical "Rickettsias" (cf. especially fig. 1). Candidly, I really am unable to make any break between the two things; if there is one I fail to see where it is. It will be noted how often one of the small bodies has a definite diplococcal shape; equally in the case of those which are darker almost black, as in those which have stained bright lilac. Again, at times the end-result is more elongated in form, when the little grains are cocco-bacillary in type (fig. 2). Here and there also a ring-form is seen (*r*).

I will here briefly refer to one point, since this must be borne in mind throughout. Those who still regard the "Rickettsias" as organisms may say that they only accept the minute granules as the "Rickettsias" and can, indeed, only feel confident as to these, when they are present in great numbers, to the exclusion, practically, of everything else. The whole trouble lies, if I may say so, in the point of view from which the study of these elements is approached. Those who have been intent on showing these things to be micro-organisms have quite naturally and rightly been bound to confine their attention to such of these elements as possessed a fairly constant and definite morphology and appearance; unless they kept within the postulated definition they would soon find themselves confronting things which they could not safely distinguish from "arte-facts," i.e., residual products of digestion. And on their view these would have to be excluded. Indeed I could think that it has not been without some self-questioning that certain of the strange forms associated with *prowazeki* and *rocha-limæ* have been included—rightly I think—in the fold.

On the other hand, those who, like myself, regard all these elements as not being micro-organisms, are, equally naturally, especially on the look-out for such dubious "forms"—evidences of the derivation of the "Rickettsias" from abnormally digested, organized material. Hence I ascribe great importance to this observation that what are undoubtedly pigmentiferous spherules of various size, of hæmatogenous origin, may become so altered that they stain with Giemsa and then appear for all the world as cocci or diplococci, simulating micro-organisms to a remarkable degree. And, bearing in mind the great variation in size of the granules of pigmenti-ferous origin which are not yet typical "Rickettsias," there is no difficulty in considering that the process of fragmentation or comminution can be carried still further, down to the minute granules which are indistinguish-able from such bodies.

The above figures were all taken from a positive smear in which the round forms of the pigmentiferous material greatly predominated. Figs. 4 and 5, on the other hand, are from another positive in which the altered hæmatogenous material is chiefly in the elongated condition, and shows a great tendency to be curved and streaky in form. In the first place, how-ever, I would draw attention to fig. 3, from a normal louse, fed on myself, which shows beautifully this delicate, streaky type of yellowish-brown pigment. Now, on careful inspection, I think it will be realized that figs. 4 and 5 show this same type of fine streaky material breaking down further

into chains of granules and numbers of separate granules. But the great majority of these granular elements are reddish-lilac in colour, and represent the "Rickettsias;" this smear, marked positive by Brumpt, is full of such! Particular indications are given as follows: (i) yellow-brown (i.e., pigment); (ii) reddish-brown (transition); and (iii) reddish-lilac to lilac ("Rickettsias").

(B) Karyolysis and the Intracellular Occurrence of "Rickettsia"-Bodies.

In the heavily "infected" smears of Brumpt, cell-destruction, with accompanying karyolysis, is taking place on a considerable scale; not only is karyolysis marked in the case of the liberated nuclei of cells which have been desquamated, but it is also occurring in component cells of fragments of the gut wall, present in the smear as a result of the teasing-up of the material. And in such cells intracellular "Rickettsia"-bodies are numerous.

Considering first the "free" disintegrating nuclei: as these are digested, they become resolved into a number of quite definite and discrete granules, coccoid or diplococcoid in form (figs. 6, 7); the process is entirely comparable with that which I have already described in the case of karyolysis in a bird-mite [16]. And these red-lilac to lilac granules are indistinguishable from many of the typical "Rickettsias" all around. Figs. 8 and 9 show this process of the breaking down of nuclear material into granules of all sizes occurring in two portions of a narrow cellular fragment. The darker band is blue-staining cytoplasm, containing large disintegrating nuclei (the denser masses). Many of the larger spherules are distinctly ring-like (*r*. fig. 8). Here, again, is every gradation in form and size down to the minute typical "Rickettsias" scattered about; it is impossible to draw any line of separation between the two things.

Figs. 10, 11, represent portions of another cellular fragment, in which the cells themselves contain numerous typical "Rickettsias." And here many of the karyolysed cell-nuclei are completely resolved into "Rickettsia"-granules indistinguishable from the separate ones (*k*, in both figs.). I confess I do not think a better demonstration of this particular mode of origin of these elements than is provided by fig. 10 could be desired.

In my previous paper I suggested that it would be found that the epithelial cells of the louse also ingest red corpuscles. And I have satisfied myself that such is the case. In fig. 11 the right hand arrow, *c*, points to a corpuscle definitely included in the cytoplasm of the cell. The hæmoglobin is as yet unaltered in colour. It may be noted that there are no free corpuscles in the neighbourhood of the cell. The other arrow marked *c* indicates a corpuscular fragment included in the nucleus itself, and surrounded by the granules resulting from the breaking down of the latter. Just the same behaviour is seen here, that is to say, as I described in the case of the nuclei of effete cells in the bird-mite. Further, as regards the

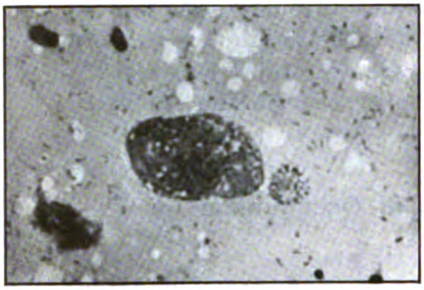


FIG. 6.

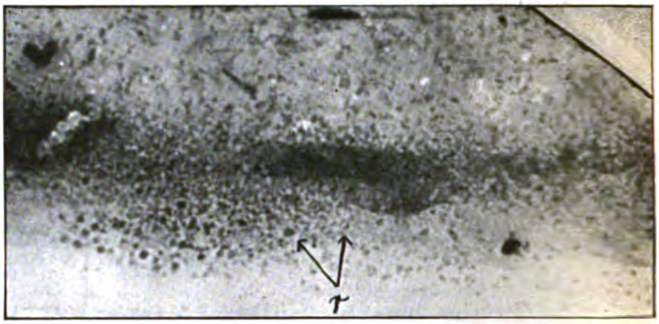


FIG. 8.

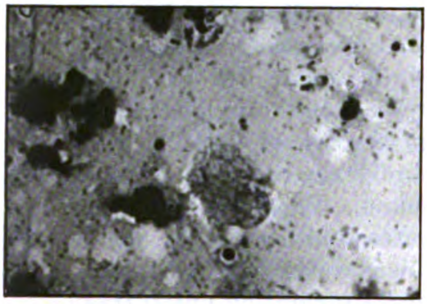


FIG. 7.

FIG. 9.

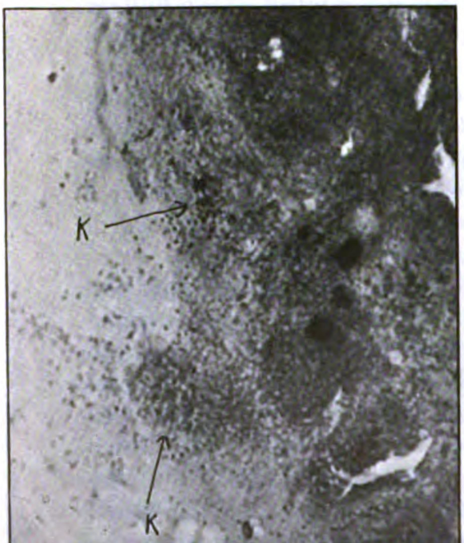


FIG. 10.

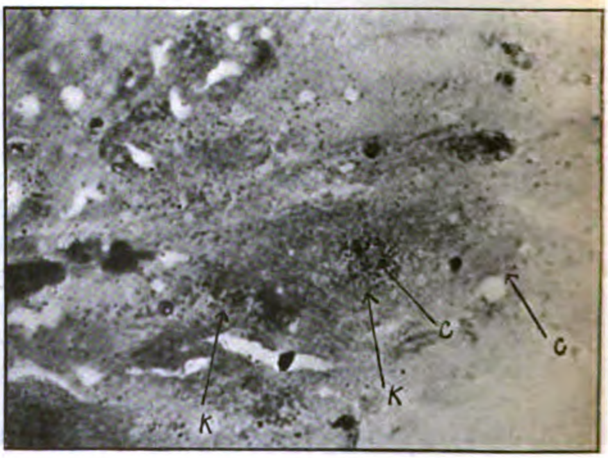


FIG. 11.

" vacuoles " frequently present in the epithelial cells, many of these, at all events are, as I thought, hæmoglobin-" vacuoles." I have observed several which still possess a faint tint of the hæmoglobin colour before the alteration has proceeded far. But no pigment is produced in this form of intracellular digestion.

Another type of "Rickettsia"-body—one characteristic of *rocha-limæ* and *prowazeki*—is produced as a result of a modified variety of karyolysis. Many of the nuclei as they break down become drawn out. At first they are irregularly elongated, but still manifestly nuclear material, i.e., representing disorganized and distorted nuclei. Later, however, either one end or both become extremely attenuated, so that a long streaky thread results. Different stages in this process are indicated by the arrows i and ii in figs. 12 to 14. Some of these elongated threads, in places, are doubtless (naturally) broken down and disorganized tails of spermatozoa, when these happen to be present in the preparation. But I have no doubt either that many of them represent altered tissue-cell-nuclei, and are derived in the manner described. Not only can any number of transitional stages be found, but they occur anywhere in the smear, far removed from any spermatozoa. Moreover, I may just mention that I have seen perfectly similar appearances in spleen-smears of guinea-pigs suffering from a certain disease where karyolysis to a very great extent also occurs. As a matter of fact, however, it does not really matter, from my point of view, whether some of these threads are fragments of spermatozoa or not. My whole point is that because of the pathological condition present in the louse, complex proteid material is being digested and the end-products are seen in these bodies and granules. How far this mode of karyolysis is an autolytic phenomenon, and how far due to the action of the pathogenic enzyme diffused in the lumen of the gut, upon the nuclei of cells which have been already liberated, I cannot say; but probably both factors are at work.

Now, I certainly think such bodies represent the thread-forms of the "Rickettsias" which have been described. By further digestion, these threads become broken up, into little chains, the elements of which ultimately separate into bipolar or ring ("vacuolated") forms. At *b*, in figs. 13-15, are seen short threads which are distinctly beaded; and at *c*, in fig. 15, are chains of three or four granules, respectively. In fig. 15 are also shown several markedly bipolar forms, another characteristic type of "Rickettsia"-body. (It need hardly be added, I think, that all these things appear of the same red-lilac colour.) Fig. 16 represents the central portion of the last figure more highly magnified (× 2,000) and gives, perhaps, a better idea of the bipolar and ring-like character of these little elements.

Along one or the other of the above two lines, therefore, I think all types of "Rickettsia"-body which have been observed in the louse can be derived.

Fig. 12.

Fig. 13.

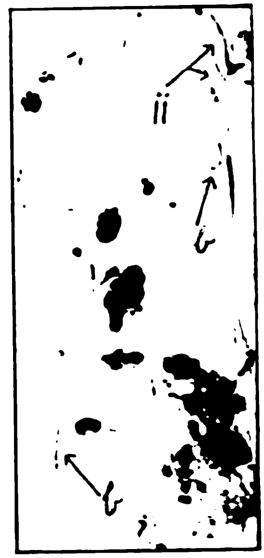


Fig. 14.

Fig. 15.

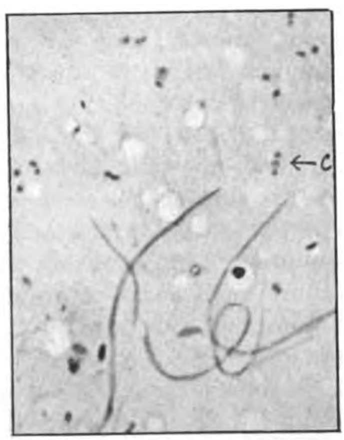


Fig. 16.

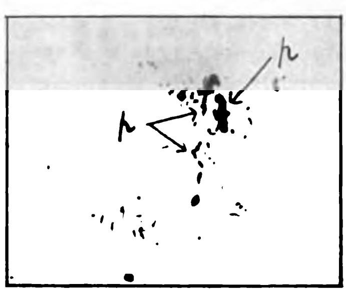


Fig. 17.

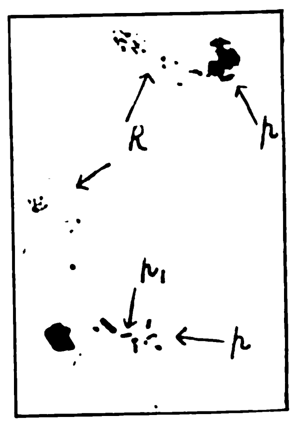


Fig. 18.

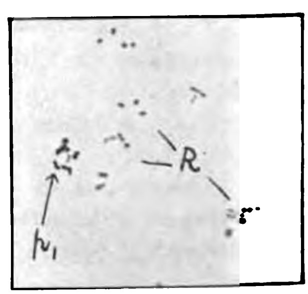


Fig. 19.

EXPLANATION OF FIGURES.

(Figs. 1 to 16, with the exception of fig. 3, from Brumpt's smears, stained by the panoptic method of Pappenheim; figs. 3 and 17 to 23, from my smears, stained with Giemsa. All the figures are magnified 1,000 diameters, with the exception of fig. 16, which is × 2,000. For description, see text.)

FIGS. 1 and 2, 4 to 16, a condition pathological for the louse alone, resulting in the production of "Rickettsia"-bodies (cf. *R. rocha-limæ.*)

FIGS. 1 and 2.—Illustrating transitions (i-iii) from pigmentiferous spherules and grains to "Rickettsia"-bodies. Fig. 2, *m*, ultimate, small "Rickettsia"-granule; *r*, ring-form of "Rickettsia"-body.

FIG. 3.—Curved and wavy forms of pigment-grains, from normal louse-excreta.

FIGS. 4 and 5. Illustrating transitions (i-iii) from such streaky forms of pigment to "Rickettsia"-bodies.

FIGS. 6 to 11.—Showing production of "Rickettsia"-bodies as a result of karyolysis, occurring both free and intracellularly. *r*, fig. 8, ring-forms; *k*, figs. 10 and 11, intracellular karyolysis; *c*, fig. 11, ingested corpuscle and corpuscular fragment.

FIGS. 12 to 16.—Showing stages in the production of thread-forms, beaded forms, chains, bipolar forms, etc., of "Rickettsia"-bodies, from drawn-out nuclei, breaking down spermatozoa, etc. *b*, beaded or segmenting thread; *c*, chains of three or four (respectively) granules. *d*, (fig. 15), black, diplococcal pigment-grain. Fig. 16 is the central portion of fig. 15, more highly magnified, to show especially the bipolar type of form.

FIGS. 17 to 23.—"Rickettsia"-bodies from the excreta of normal lice.

FIGS. 17 to 19, and 23.—Illustrating transitions between pigment-grains and "Rickettsia"-bodies. *R*, "Rickettsia"-bodies; *p*, pigmentiferous masses and grains; p_1, figs. 18 and 19, pigment-grain with distinct indication of bipolarity, the two ends being more deeply coloured; *c*, fig. 23, fragment of desquamated cell-cytoplasm.

FIGS. 20 to 22.—Coccal and diplococcal forms of "Rickettsia"-body and their relation to the pigment. (Lettering as above.)

(To be continued.)

A MEDICAL EXERCISE SET FOR A RECENT EXAMINATION.

By Colonel E. T. F. BIRRELL, C.B., C.M.G., and
Major R. L. V. FOSTER, M.A., M.B.
Royal Army Medical Corps.

The scheme of this exercise was set for candidates in the South-Western Area, Southern Command, for the examination of majors, Royal Army Medical Corps, for promotion to lieutenant-colonel, under King's Regulations, Appendix XII, Part II, in August, 1923. The solutions are the work of R. L. V. F., who was one of the successful candidates, and the whole is now, after slight amendment at more leisure than the examination afforded, offered for perusal by other candidates for this examination in case it may be found useful. As Field Service Regulations, vol. I, of 1923, are now in use for examinations, the scheme, which was drawn up on Field Service Regulations, Part II, reprint 1914, has been amended. Our thanks are due to Headquarters, 8th Infantry Brigade, for the use of the tactical scheme on which the medical exercise was founded.

General Idea.

Reference 1 *inch O.S. Map Sheets* 349 *and* 355 (*combined*) *and* 4 *miles to* 1 *inch Sheets* 8 *and* 9.

On June 12, 1923, Eastland, comprising the counties of Hampshire, Wiltshire, Dorset, and Somerset, with capital at Salisbury, declared war on Westland (capital Plymouth) comprising the counties of Devon and Cornwall.

As soon as war was declared, the Eastland fleet sought out and attacked the Westland fleet off the south coast of Devon. On June 13 the Westland fleet was heavily defeated, and what remained of it took refuge in Plymouth harbour, where it was blockaded by the Eastland fleet.

The main armies of Eastland and Westland came into contact about thirty miles north-east of Exeter. Heavy but indecisive fighting took place between July 26 and 29, and no advantage could be claimed by either side.

Note.—Moral and armament of forces of Eastland and Westland approximately equal, and similar to that of the British Army.

Special Idea (Medical).

General headquarters, Westland, is in the field with the main army. The commander, lines of communication area (the whole of Westland less the areas occupied by field formations), is at Plymouth. The director of medical services is with general headquarters; the deputy director of medical services, lines of communication area, is with the commander of that area. At Plymouth there are army hospitals aggregating 3,500 beds, of which 2,000 are already occupied by casualties from the main army.

No more hospitals can be opened, as naval casualties have taken up all other accommodation. There are also in Plymouth a base depot of medical stores, twenty-five motor ambulance cars of a motor ambulance convoy, and the usual medical and sanitary units of a base. Ambulance trains are running between the main army and various hospital centres in Westland, including Plymouth.

NARRATIVE.

On the morning of July 29 the general officer commanding, 3rd Cornish Division, Westland Army, who had just completed the mobilization of his division at Plymouth, received the following telegram in cipher from general headquarters, Westland Forces :—

> "Have received reliable information that an Eastland force, estimated at one division, left Southampton on July 28 with orders to land at some point or points on the Devon coast and seize Plymouth. You are to take whatever steps you consider necessary to defeat this enterprise." WESTLAND G.H.Q."

At the same time the commander, lines of communication area, received instructions from general headquarters to arrange rearward services (including medical) for the 3rd Division in view of the above order.

REQUIRED. FIRST TASK.

As deputy director of medical services, lines of communication area, write an appreciation of the situation as regards disposal of casualties from the 3rd Division in the event of fighting taking place.

FIRST TASK.

Appreciation.

Object.—To provide hospital accommodation and transport on the lines of communication from the frontal areas for casualties arising from the possible fighting of the 3rd Division.

Factors.—(i) For how many casualties is it likely that accommodation will be required ? The assistant director of medical services, 3rd Division, who must also be considering this question from his point of view, and has presumably conferred with the divisional staff, should be consulted. There is nothing very definite to go upon, except that both forces are about the same strength. An estimate of ten per cent casualties would probably be a safe basis on which to make arrangements. Ten per cent of three-fifths of 17,500 (i.e., the probable number of Westland troops actually to be engaged) would result in 1,050 total casualties, of which 840 (i.e., four-fifths), or say 900, would be wounded.

(ii) The accommodation available is 1,500 beds in army hospitals at Plymouth (subject to the military situation permitting, see later), and an unspecified number at hospital centres elsewhere in Westland.

(iii) The transport available consists of ambulance trains from those

running to Plymouth and other hospital centres, which could be deflected (if possible), and twenty-five motor ambulance cars which might be supplemented by an additional part of a convoy from reserve (if any) at general headquarters with the consent of the director of medical services, or by motor omnibuses or local transport requisitioned by headquarters, lines of communication area.

(iv) The locality of the fighting area is unknown, but will probably be near the coast of Devonshire and at no great distance from Plymouth.

(v) As regards communications, there are in most places good roads, and there is the main Great Western Railway line either on the coast or in communication therewith by branches, single line, to Torquay, Dartmouth (Kingswear), and Salcombe (Kingsbridge).

(vi) It is desirable from a medical point of view that Plymouth be used as the hospital base for 3rd Division casualties if possible, as it has all the medical resources of a capital town, with medical base units such as a depot of medical stores, sanitary units, laboratories, etc. It is also the centre of railways and roads. Accommodation there is at present sufficient (1,500 beds) for the 900 expected casualties, but there are also to be considered the normal sick admissions (one-half of 0·3 per cent) from the Plymouth garrison, strength unknown, and say thirty sick casualties per diem from the 3rd Division now mobilized there. On the other hand, if Eastland effects a landing and the 3rd Division should be compelled to withdraw, Plymouth would be seriously threatened; it is (*vide* General Idea) already blockaded by sea. The use of Plymouth as a hospital base is therefore a matter for the commander, lines of communication area, to decide.

Courses open to deputy director of medical services, lines of communication area. (i) As regards hospital accommodation: (*a*) to consider Plymouth as the medical base for the 3rd Division and to utilize army hospitals there, either without, or, preferably, with initial clearing to other hospitals in the interior of Cornwall, e.g., at Bodmin, Liskeard, Truro, Falmouth or wherever hospital centres happen to exist; (*b*) to evacuate all casualties direct from the fighting areas of the 3rd Division direct to interior hospitals.

(ii) As regards transport: (*a*) to rely entirely on ambulance trains. Against this is the fact that ambulance trains might not be available, or the railways blocked; also that if fighting occurred in the area South Brent—Modbury—Kingsbridge—Halwell—the wounded might not be near the line, or the single line might not be available for the purpose when required; (*b*) to use the twenty-five ambulance cars for removing lying-down cases, probably about 200 in number, from the field to ambulance trains at a convenient point, or to Plymouth direct, supplementing them by obtaining local transport or motor omnibuses for sitting-up and walking cases. This would be feasible if extra transport could be obtained, and if the journey for road transport was not over twenty-five miles.

Plan of Action.—(i) To see the commander, lines of communication area, and ascertain how far he wishes Plymouth to be utilized as a medical

base for the 3rd Division. If he approves, to begin clearing the army hospitals at Plymouth to other centres to relieve the pressure, by the twenty-five ambulance cars or by ambulance trains. In the event of refusal, to prepare other hospitals in the interior of Cornwall to take the expected casualties, and the patients already in Plymouth, if it is to be cleared.

(ii) To see the quartermaster-general's branch at communications headquarters and ascertain if any assistance can be expected by the provision of motor omnibuses, lorries, or local transport.

(iii) To take steps either to deflect ambulance trains to Plymouth, or to retain sufficient there for the operations of the 3rd Division.

(iv) To ask the director of medical services if more motor ambulance cars can be provided, and explain to him the course of action being taken.

(v) Interview the assistant-director of medical services, 3rd Division.

NARRATIVE (*continued*).

Throughout the afternoon of July 29 unconfirmed reports were received at 3rd Divisional headquarters that enemy transports had been seen off Torquay and Brixham, and that the enemy was disembarking at these points. Other reports were received that the enemy had landed near Tregantle (in Cornwall).

At six a.m., July 30, the general officer commanding, 3rd Cornish Division, received reliable information that Eastland had actually landed two infantry brigades with some artillery and transport at Dartmouth, and one infantry brigade with some artillery and transport at Salcombe. All these troops were under orders to march early on July 30 on Plymouth.

Acting on this information, the general officer commanding ordered the 3rd Cornish Division to move eastwards at once on a two-brigade front, with the intention of attacking the enemy at the earliest favourable opportunity.

SUMMARY OF ORDERS.

(1) The South Devon Yeomanry were ordered to: (*a*) locate the enemy; (*b*) find out the direction of his march and report the same; (*c*) keep in touch with enemy columns and delay their march without becoming involved.

(2) 8th Infantry Brigade and 15th Brigade, Royal Field Artillery, were ordered to march via Yealmpton on Flete.

(3) 9th Infantry Brigade and 25th Brigade, Royal Field Artillery, were ordered to march via Plympton on Ivybridge.

(4) 7th Infantry Brigade and remainder of the division to Plympton.

(5) 8th and 9th Infantry Brigades were to make good the River Erme, and to hold the bridges over the river.

(6) Dividing line between 8th and 9th Infantry Brigades: Billacombe (north of Plymstock)—E. Sherford—Stonycross—Worston—Longbrook—Ermington (all inclusive to 8th Infantry Brigade).

(7) 8th Infantry Brigade, 15th Brigade, Royal Field Artillery, and 8th Field Ambulance to form the 8th Infantry Brigade Group. 9th Infantry Brigade, 25th Brigade, Royal Field Artillery, and 9th Field Ambulance to form the 9th Infantry Brigade Group.

REQUIRED: SECOND TASK.

(1) As assistant director of medical services, 3rd Division, write an appreciation of the situation in view of the orders summarized above.

(2) Write your orders to field ambulances.

Note.—The ambulances of the division are the 7th, 8th and 9th Field Ambulances.

SECOND TASK.

(1) *Appreciation.*

Object.—To collect and evacuate where necessary the wounded or sick of the 3rd Division.

Factors.—(i) It was decided to clear and evacuate the war hospitals at Plymouth. This has been proceeding rapidly since yesterday morning by means of ambulance trains, and they are expected to be clear by noon on July 30.

(ii) A hospital in Plymouth is in course of being prepared to act as a casualty clearing station, and should be ready to receive casualties by 22.00 hours, July 30.

(iii) The twenty-five motor ambulance cars have been placed at the disposal of the assistant director of medical services, supplemented by six motor omnibuses suitable for slightly wounded, walking, and sitting-up cases.

(iv) The enemy have effected a landing at Dartmouth with two infantry brigades, artillery, and transport, and at Salcombe with one infantry brigade, artillery and transport.

(v) They are marching on Plymouth.

(vi) The 3rd Division is ordered to march eastward on a two-brigade front. The 8th Infantry Brigade with 15th Brigade, Royal Field Artillery, and 8th Field Ambulance as 8th Infantry Brigade Group are to march on Flete. The 9th Infantry Brigade with 25th Brigade Royal Field Artillery and 9th Field Ambulance as 9th Infantry Brigade Group are to march on Ivybridge. The 8th and 9th Field Ambulances consequently will pass out of the immediate control of the assistant director of medical services; but he will still be responsible for clearing them, and should give such instructions as will ensure their main dressing stations being so sited that they can be readily cleared.

(vii) The 8th and 9th Infantry Brigades are to make good the River Erme and hold the bridges over the river. This defines the fighting area.

(viii) The River Erme, north of Flete, is a shallow and narrow stream and offers no real obstruction to an advancing enemy, but there are only

three main roads to Plymouth from the east suitable for military transport, and these roads cross the River Erme at Ivybridge, Ermington, and half a mile north of Flete respectively. The distances by road from Plymouth to these three places are approximately ten to twelve miles.

(ix) The casualties to be expected may be taken at 900.

(x) The transport available with field ambulances is sufficient to remove casualties to main dressing stations. The twenty-five motor ambulance cars, supplemented by local transport, are sufficient to clear main dressing stations to Plymouth, only some eight or ten miles away.

(xi) The extensive use of gas, or the presence of any considerable amount of heavy artillery are unlikely in a force so rapidly landed in a hostile country, but the divisional staff would be consulted on these points.

Plan of Action.—(i) Obtain from the general staff any information on factors mentioned in xi.

(ii) Ascertain from the quartermaster-general's branch what stocks of reserve stretchers and blankets are held, and what stocks of spare clothing, chloride of lime, etc., are available, in view of the possibility of gas being used.

(iii) Send out orders to field ambulances as per answer to question 2, allotting them to brigade groups and intimating the change of organization.

(iv) Inform the officer commanding the detachment motor ambulance convoy of the general scheme, and the probable position of the main dressing stations which he will have to clear, and direct him to form his headquarters at Plympton.

(2) *Orders to Field Ambulances.*

3RD DIVISION R.A.M.C. Order No. 1.

SECRET.
Copy No.

(ISSUED REFERENCE 3RD DIVISION ORDER NO. 1.)

July 30, 1923.

Reference 1 *inch O.S. Map Sheets* 349 *and* 355 *combined.*

(1) (*a*) Enemy troops, approximately one division, have landed at Dartmouth (ten miles north-east of Kingsbridge), and Salcombe, and are expected to attempt to advance on Plymouth.

(*b*) The 3rd Division is marching this morning to hold the River Erme and attack the enemy. The 8th Infantry Brigade Group is to march via Yealmpton on Flete, the 9th Infantry Brigade Group via Plympton on Ivybridge.

(2) 8th Field Ambulance is allotted to 8th Infantry Brigade Group, 9th Field Ambulance to 9th Infantry Brigade Group. These ambulances will receive orders for the march from infantry brigade group commanders.

(3) 7th Field Ambulance will march to Plympton, hour of starting (as may have been decided when the divisional order was drawn up).

(4) Subject to the orders of infantry brigade group commanders, the main dressing stations of 8th and 9th Field Ambulances should be on or

near main roads to facilitate evacuation. Their location, as soon as opened, will be reported to A.D.M.S. at divisional headquarters Plympton.

(5) Evacuation of main dressing stations will be effected by a convoy of twenty-five motor ambulance cars and six motor omnibuses under the orders of A.D.M.S.

(6) Reports of numbers remaining in main dressing stations at 12.00, 16.00, and 20.00 hours will be sent to A.D.M.S. at divisional headquarters, Plympton. The report at 12.00 hours will also state the numbers evacuated. Subsequent reports will also state the numbers evacuated since previous report.

(7) Acknowledge:—

(Sgd.) H. J., Major,
D.A.D.M.S., 3rd Division.

Issued at 07.00 hours.

Issued to:—7th F. Amb.
8th F. Amb.
9th F. Amb.

Copies to:—H.Q., 8th Inf. Bde. Group.
H.Q., 9th Inf. Bde. Group.
O.C., Det. No. Motor Amb. Convoy.
G. A and Q. D.M.S. File.
War Diary.

NARRATIVE (*continued*).

Reference ½ *inch O.S. Map Sheet* 36.

After indecisive fighting on July 30, 31 and August 1, the enemy was strongly reinforced on the evening of August 1, and the 3rd Cornish Division retired to the north of Plymouth, which was occupied by Eastland troops on August 2. The commander, lines of communication area, Westland forces, and his headquarters had moved to Launceston on August 1.

On August 3 the 3rd Cornish Division and a second division from Cornwall was strongly entrenched on a line, roughly east and west just south of Yelverton, Tavistock being railhead for ammunition and supplies for these divisions.

A casualty clearing station, under the deputy director of medical services, lines of communication, is to be opened at Tavistock, to which casualties from the Yelverton position will be brought by a motor ambulance convoy, also to be at Tavistock, and which will be cleared by ambulance train to hospitals west and north-west of Tavistock. The casualty clearing station is mobilizing at Launceston and is expected to be ready to entrain on August 5. It is equipped with stretchers (with trestles) for 300 patients, and tentage (if required) will be issued; personnel eight officers, eighty other ranks. It has full operating equipment and a dental centre, and five sisters, Queen Alexandra's Imperial Military Nursing Service, will be attached. The unit is to be opened immediately on arrival.

REQUIRED: THIRD TASK.

As an officer detailed by the deputy director of medical services, lines of communication area, for the special duty, make a reconnaissance of Tavistock on August 3, with a view to selecting a site for the casualty clearing station, and reporting on the facilities for entraining cases for evacuation by ambulance train.

The ammunition and supply dumps and lorry parks are in the neighbourhood of the railway stations. Otherwise the general situation in Tavistock is normal.

THIRD TASK.

Report of Reconnaissance, Tavistock.

Casualty Clearing Station.

Three possible sites for the casualty clearing station were found, which, taking them in order of suitability, are:—

(1) Kelly College. Numerous blocks of modern buildings, comprising the dormitories, dining halls, class rooms, halls, gymnasium and offices usual for a public school taking about 200 boys. For the purpose of a casualty clearing station these buildings, together with two residential boarding-houses (masters' houses), would be highly suitable and readily converted at a few hours' notice into a good clearing station. It is situated on a main road, three-quarters of a mile from the town. It has a single line, Great Western Railway, one hundred yards distant from and parallel to the main road, separated by a level grass field. It would be advisable to construct, say, one hundred yards of line where ambulance trains could be placed on a siding to avoid blocking the main line; or to run a siding across the high road into the playing fields below and immediately in front of the college buildings, in which case hand carriage could be adopted, and there would be no necessity for motor transport. The Royal Engineers could probably lay this line on the level within forty-eight hours, if railway material is available. Water supply, lighting (electric) and heating are installed. At this season the school is, of course, unoccupied.

(2) The municipal buildings and market place. The market place itself is a large, closed-in hall with paved floor, about sixty-six by thirty-three yards in area, and should accommodate 200 of the more slightly wounded. There is a road around the building with separate ingress and exits. Immediately surrounding are buildings which could be formed into smaller halls or offices. Facing the market place is a large, broad room, used as a town hall, well lit on the first floor, with suitable access for stretchers. This would make a good ward for about forty serious cases, and an operating room. Water, if not already at hand (it was not possible to gain access to the room), could easily be laid on. There are numerous rooms suitable for the staff and offices, stores, etc., in the block of buildings. In a separate block there is a municipal library which could be altered for cases not requiring stretchers. The Bedford Hotel, opposite the Municipal Buildings,

has twenty-five bedrooms, a dancing room, lounge, etc., and could be be utilized in addition if required.

The objections to this site are that a market hall is not very desirable for hospital patients. There is difficulty of heating and avoiding draughts. Sanitary arrangements would have to be inserted. There is no equipment, furniture, etc. The site is not sufficiently near the railway stations or lines to permit of hand carriage, being about half a mile from each station.

(3) A grass meadow lying to the south-west of the Great Western Railway station, 200 yards from it. This is on a gentle slope, bounded on the higher side by the Great Western Railway line, and on two sides by good metalled roads. Adjoining the meadow is a private residence with town water supply and electric light, which could be utilized for special cases or officers' and nursing sisters' accommodation. A small factory (three floors) which is close by could be utilized for personnel, R.A.M.C., and light cases (walking only). A large area of playing fields, tennis-courts, and park is separated from the actual site by the River Tavy. This is crossed by an iron foot-bridge, not suitable for wheeled traffic. The river is shallow and narrow and could be easily spanned by a rapidly constructed wooden or pontoon bridge. This would give ample space for tents, even of a large general hospital.

The points in favour of the site are (1) proximity to railway line and good roads; (2) town water supply and electric current on the site; (3) sheltered position and good aspect.

The objections are: (1) with only forty-eight hours it would be a difficult task to erect the necessary tentage, get water and electric light laid on and the site prepared; (2) the site might be already occupied by other units, ammunition, supply, or lorry parks.

Facilities for Entraining at Stations.

There is a suitable siding for ambulance trains at both the Southern (London and South Western Railway on map), and Great Western Railway stations. The road accommodation for handling motor ambulance cars along the siding is in both cases rather cramped, but is quite feasible with careful traffic control. Both stations have end-loading platforms or ramps. There is little or no covered accommodation suitable for a reception station, except the usual buildings of the passenger stations, which are about one hundred yards from the goods sidings. The approach to the Southern Railway station is narrow, up a steep gradient with hair-pin bend, and on this account that station is unsuitable for the purpose required, and the Great Western Railway station should be utilized. Both stations are about half a mile from the centre of the town, and the Southern and Great Western Railways are in conjunction at Lydford station, the branch line to Launceston; therefore neither has any particular advantage in this respect.

Clinical and other Notes.

ADEN.

By Lieutenant-Colonel G. W. G. HUGHES.
Royal Army Medical Corps.

Before starting on a description of Aden as a station, I should like to make the suggestion that something in a form of a gazetteer—a guide-book—call it what you like, be made of the many stations to which we may be posted. From time to time there have been useful articles in this Journal on many places. But one cannot hunt up old numbers to see if anyone has ever described such a spot as Aden. But if these articles were bound together, supplemented by others, and kept more or less up-to-date, surely numbers of officers would find it most useful. Of course such a book might be made an Army publication and not purely Army Medical, but I feel sure that such a source of information would pay for the expense of publication. I suggest that the Corps Journal should seriously consider the matter.

I have written the above remarks with some feeling as I knew nothing of Aden before I passed it on my way home on leave, I had never stopped at the place nor had I heard anything about it, except that it appeared to be one of the most poisonous spots one could be sent to. It was quite a surprise to me to learn from some people who came on board at Aden that they really liked the place and that apparently most people who had been there spoke quite well of it. My wife and I have been here for nearly a year and, for our parts, we can say with all sincerity that we have thoroughly enjoyed it and would prefer being here to what we have seen of India.

Perhaps I had better follow the headings of a guide-book.

Topography.—Aden is almost an island. There is an isthmus of sand about a mile broad, which connects it with Arabia.

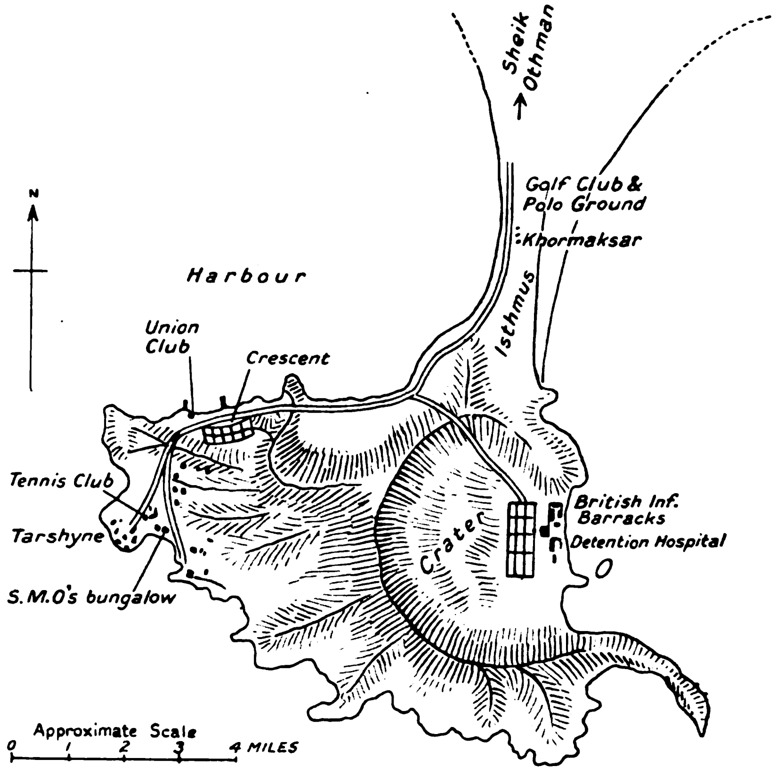
At Steamer Point the sea is on three sides, and if there is any wind, it usually blows alternately north to south or south to north. This is particularly so on what is called Tarshyne, a small promontory on which are built most of the officers' bungalows.

Towering behind Steamer Point are the heights of Shum-shum, the lips of the crater of an ancient volcano. Within the semicircle of these heights is built the town of Aden, which we call the Crater. Here, besides a fairly large native town, are the British and Indian infantry barracks, an Indian station hospital, and a section of the British station hospital.

Brigade headquarters, barracks for Royal Garrison Artillery and a detach-

ment of the British infantry battalion, and the British Station Hospital are at Steamer Point. From Steamer Point to The Crater is about six miles.

At Khormaksar, on the isthmus connecting Aden with the mainland, are quartered a Pack Battery, some Royal Air Force, and a wireless station. Further on, on the mainland, is a small Arab town, Sheikh Othman, where are the headquarters of an Arab battalion, the Yemen Infantry. There is one outpost, Hubil, thirty miles from Aden, in the interior. Also one should mention Perim and Kamaran, in the Red Sea, which come under



the Aden Brigade. Small detachments of Yemen Infantry are there. The Royal Army Medical Corps are in no way interested in any of these three places.

Climate.—The hot months are May, June, July, and it is hot again in September. August is wonderfully cool and pleasant, that is, at Steamer Point; in other parts of Aden the dust and heat have been abominable. On the whole, the heat is not nearly so bad as in most parts of India. The thermometer seldom goes above 90° or below 70° at any time, but it is a damp heat. The Crater is at least 10° hotter than Steamer Point.

Fortunately, there is nearly always a breeze blowing. The breeze is apt to develop into a very strong wind, especially during the monsoon. It

unpleasant. Luckily, these uncomfortable intervals do not last more than is when the wind drops that Aden is at its worst and it is then most an hour or so.

Health.—Aden is a wonderfully healthy place. There is no malaria. Although there are a few Stegomyia, mosquito nets are not necessary. The only tropical disease seems to be a "seven day" fever, of a mild dengue type.

The cooking arrangements require as careful inspection as they do all over the East. What is called "Aden Tummy," an unpleasant result of eating tainted food, is by no means peculiar to Aden.

Prickly heat, in the warmer months, is a trial to most people.

Aden is not a good place for children. Although it is not really too hot, and there is no actual disease, and there are fine beaches to play on, yet children seem to become paler and more pathetic-looking daily.

Accommodation.—Most cantonment bungalows are poorly-built, thatched roof affairs, belonging to Government. The rents vary between 35 and 76 rupees. Occasionally there are not enough bungalows to go round. It is wise for married men to write in advance to brigade headquarters to ask for one to be reserved. There is, however, one bungalow reserved for the A.D.M.S., and one for the O.C. British station hospital, and usually arrangements can be made for at least one other married Royal Army Medical Corps officer. There is no electric light or fans in these bungalows.

In the Crescent, which is close to where one lands off ships, there are two indifferent hotels, the Grand Hotel and the Hôtel de l'Europe.

It would make a vast difference to the place if gardens were possible. Seeds sometimes struggle to grow, but as a rule the seedlings wilt away in a depressing manner.

Furniture, etc.—Ancient, tired-looking furniture can be hired fairly cheaply. The usual cretonnes for cushions and chairs should be brought. Curtains are useless, they are blown about by the constant wind.

Punkha-proof lamps are a necessity and difficult to obtain locally. Some sort of vapour lamp, such as the Blanchard, is advisable.

It is usual to decorate rooms and dining-tables with artificial flowers, which also should be brought.

No china or glass is obtainable in the place except of poor quality.

Amusements.—The Union Club, Steamer Point, is a non-residential club to which ladies are admitted.

There is a Tennis Club at Steamer Point and another at the Crater.

The Golf and Polo Club is at Khormaksar. Ponies are difficult to obtain, and Khormaksar is eight miles from Steamer Point.

There is a Bathing Club, and nets (to keep sharks away) are put out daily.

There is excellent sea-fishing for those who are good sailors. The fish run to twenty or thirty pounds in weight. Some years ago there was very good sailing here, but the boats were all wrecked at their moorings in a

storm and, since the war, nobody has had the initiative or capital to import new boats.

Shooting is not good. It is possible, in the winter, to get a few duck, snipe and sand grouse, but it entails going a good way and results are apt to be poor.

Those who are keen on botany can find many varieties of wild flowers to interest them. There are also butterflies to be collected and many varieties of sea-shells.

Leave from Aden.—Residents sometimes go, for a month or two, to Asmarra, in Eritrea, where in Italian territory living is cheap and the climate cool.

Shooting trips to Somaliland are possible, but unless fairly long leave be taken, it appears difficult to obtain good sport.

A small Royal Indian Marine station ship takes a monthly trip round some lighthouses in the Red Sea, visiting Perim and Kamaran. There is accommodation for a few passengers. The trip takes a week, and in cool and calm weather is a pleasant change.

Aden has no hill station.

Motors.—A car or motor cycle is almost a necessity. It is a long way to everywhere. Taxis can be hired at eight annas a mile but this comes expensive. Aden is a free port and a new Ford can be bought for about £100.

Servants.—Wages are higher than in India. Cooks, 40 to 50 rupees; butlers, 30 to 40 rupees. It is a mistake to bring Indian bearers; they are not happy, and they quarrel with the local natives. There are a few Goanese cooks but they ask very high wages. Arab servants are much better than the usual Somali, who, even if honest, is a fool.

Shopping.—The shops are mostly in the hands of Parsees or Jews. Beyond groceries they contain little else that is not rubbish.

Groceries are no cheaper than in India. It would be economical to bring out a box from home, but to import direct does not save much although the groceries would undoubtedly be fresher.

Meat consists mostly of mutton, and is poor in quality. Fish is good and cheap.

Milk and butter are supplied by the Government dairy.

Banks.—National Bank of India; Cowasjee, Dinshaw (agent for Grindlay & Co.).

Garrison.—One British infantry battalion; one Company Royal Garrison Artillery (Siege); one pack battery; one Indian infantry battalion; one Arab infantry battalion; and the usual departments.

There are usually four Royal Army Medical Corps officers and twenty other ranks.

The British Station Hospital, Steamer Point, has 100 beds. Families' Hospital, ten beds, including two for officers' wives.

The Detention Hospital, Crater, has ten beds.

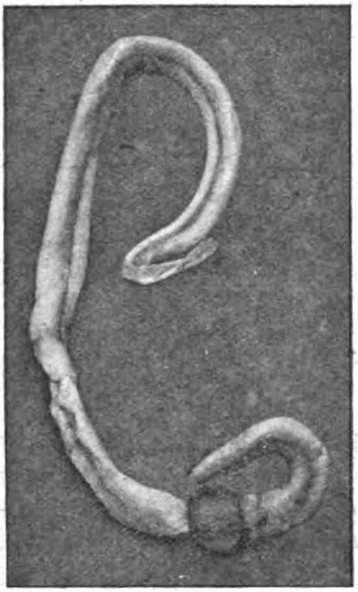
There are five nursing sisters of the Q.A.I.M.N.S.

ASCARIS LUMBRICOIDES ENCIRCLED BY A GLASS BEAD.

By Major W. J. E. BELL, D.S.O.
Royal Army Medical Corps.

The worm (*Ascaris lumbricoides*) was passed on July 24, 1923, together with eighteen others by a little girl, aged 2, after the administration of anthelmintics. She had already passed eight worms on the previous day.

The object encircling the "neck" of the worm is a blue glass bead which had evidently been swallowed by the child at some period prior to the



full growth of the parasite. The bead is of the kind commonly used to weight the edges of those small muslin covers which are employed to protect food from flies.

The worm was passed exactly as shown. The photograph was taken by Messrs. Mahadeo and Son, photographers, Belgaum.

IMPETIGO.

By Lieutenant-Colonel W. M. B. SPARKES, D.S.O.
Royal Army Medical Corps.

The following observations may be of interest to other medical officers in the Corps:—

In Lichfield there have been a number of cases of impetigo amongst the

recruits, and it was noticed that the eruption was practically always on the face and in many cases it commenced on the right side.

An officer reported sick with impetigo on the face and one wondered how he had contracted the disease. On inquiry it was found that in the musketry course he had been instructing recruits how to sight their rifles. He noticed that one man had sores on his face and mentioned his name; this man had recently been admitted to hospital with impetigo.

This history gave thought, and immediately the source of infection was apparent.

I am sure that a great many cases of impetigo on the face are due to infection from the rifle butt.

To prevent the spread of Impetigo from this source I think it is advisable for medical officers in charge of units to point out to officers commanding the necessity of close supervision by officers and N.C.O.'s so that when a soldier is seen to have sores on his face he may be sent to the medical officer, and as a precautionary measure his rifle butt disinfected.

Very often these things are brought to notice and soon forgotten, but the medical officers in charge of units can always bring the point to notice in their lectures.

Current Literature.—Hygiene.

Reports on Public Health and Medical Subjects, No. 20, 1923. Ministry of Health.—The Medical Officer of Health of the district of Lynton in Devon, reports on thirteen cases of gastro-enteritis of obscure origin that occurred amongst the civil population of Lynton during the summer of 1922.

The disease, which was attended with alarming fatality, no less than four deaths having occurred, was characterized by diarrhœa accompanied by severe tenesmus, the passing of much blood and mucus in the stools and enteric symptoms, followed in the fatal cases by collapse.

The long duration of the illness—five to six weeks in non-fatal cases—the absence of pronounced gastric symptoms or prolonged fever and the evacuation per rectum of little else than blood and mucus indicated dysentery. Microscopical and bacteriological investigation of the dejecta yielded no evidence of amœbæ, or infection with enteric or specific food poisoning organisms.

After many negative bacteriological investigations *Bacillus dysenteriæ* Flexner was isolated from a case of the disease in a child, aged 6, the son of a foreman employed on a dairy farm whence all the people affected had obtained their milk. This foreman and one of the farm hands were ex-soldiers who had been invalided from the Eastern theatre of the war with symptoms suggestive of dysentery. The farmer had also

suffered from dysentery whilst serving with the Army in the East during 1917, but had shown no recent symptoms of this disease. He took an active part in handling and distributing the milk.

Specimens of blood and rectal swabs were taken from these men and it was found that the serum of the farmer and of his foreman agglutinated *B. dysenteriæ* Flexner, and this microbe was isolated from rectal swabs taken from the foreman.

In November another patient contracted the disease and a pure growth of *B. dysenteriæ* Shiga was isolated from his fæces. After this, eighteen cases of bacillary dysentery were noted in eleven households, of which thirteen occurred in children. Further exhaustive bacteriological examinations of the stools of the foreman above mentioned showed that he was suffering from a mixed infection of *B. dysenteriæ* Shiga and Flexner, and an atypical *B. dysenteriæ* Flexner was now isolated from the farmer also.

Serological examination of four sufferers from the disease gave further confirmatory evidence of the nature of the infection.

This outbreak of dysentery is of interest by reason of the completeness with which it had been possible to co-ordinate the epidemiological and bacteriological findings. These leave no doubt in the mind of the authors that the source of the disease was an active carrier or carriers of *B. dysenteriæ*. The peculiar character of the outbreak and its abrupt termination on the withdrawal from the dairy farm of a proved carrier of dysentery bacilli support the view that the infection was carried by milk, though the specific organisms were never isolated from it.

The period during which the farmer's foreman had presumably been a carrier of *B. dysenteriæ* is of unusual length. This man was invalided out of the Army in 1919, after suffering in the East from dysenteric symptoms and had no recurrence of such symptoms from that date.

Byam and Archibald in their "Practice of Medicine in the Tropics," article Bacillary Dysentery, vol. ii., give the following table regarding the duration of the period of infectivity of chronic carriers.

CHRONIC CARRIERS OF THE *B. dysenteriæ* Shiga—(67 CASES).

Positive 4 months from onset	77 per cent
,, 6 ,, ,, ,,	19 ,,
,, 12 ,, ,, ,,	4 ,,

CHRONIC CARRIERS OF *B. dysenteriæ* Flexner—(271 CASES).

Positive 4 months from onset	50 per cent
,, 6 ,, ,, ,,	34 ,,
,, 12 ,, ,, ,,	7 ,,

A. E. H.

Preliminary Report on the Use of Hydrogen Cyanide for Fumigation Purposes. By Drs. P. G. Stock and G. W. Monier-Williams ("Reports on Public and Medical Subjects," No. 19).—The authors begin by pointing out that hydrogen cyanide is not a bactericide, and is never used for

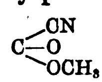
ordinary purposes of disinfection. In practice its use is confined to the destruction of insect pests of plants and of man, and to the destruction of rats on board ship.

Then follows a brief history of hydrogen cyanide and its introduction as a fumigant.

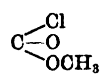
The advantages claimed for the method when fumigation is necessary for the destruction of rats or other vermin on board ship are: Its quickness and efficiency, its freedom from the risk of fire, the absence of damage to metal work, paint, fittings, and cargo, and its relative cheapness. It is shown also that hydrogen cyanide is more efficient than sulphur dioxide, the latter being considered effective only in empty holds.

The disadvantages are the deadly nature of the gas, the small amount of warning given by the fumes and the difficulty of enforcing safety regulations.

With a view to giving adequate warning to a person entering a compartment in which cyanide gas is present in dangerous quantities, cyanogen chloride gas mixture has been introduced in America and "Cyklon" in Germany. The former is produced by mixing sodium cyanide 4 ounces, sodium chlorate 3 ounces, talc. 2 ounces, hydrochloric acid 17 ounces, and water 17 ounces. This gives cyanogen chloride and hydrogen cyanide in molecular combination, lachrymation is caused even in non-toxic doses, and so due warning is given. "Cyklon" is an expensive proprietary substance, containing probably ninety per cent of methyl cyano-formate



which disinfects, and ten per cent of methyl chloro-formate



which irritates the eyes and nasopharynx.

Methods of Application.—The authors describe methods of generating the gas either inside the ship by the "Solid," "Dumping," or "Tipping" Method, or the "Solution" Method, or outside the ship by the Grubb's Generator or the Glen Liston apparatus. These last named entail the use of much heavy apparatus, but it is claimed that the method does away with the disadvantages of the "dumping" method, in which the gas is evolved with explosive rapidity, and so in high and dangerous concentration, and in which in addition there is no control and a tendency to "pocket." *Liquid hydrogen cyanide* is also used, being put in steel cylinders, from which it is pumped, or in glass ampoules, which are thrown into the spaces to be fumigated. Transport difficulty is the main objection to its use.

When the gas is to be generated inside the ship, the method described is to obtain convenient containers, e.g., oak barrels, and line them with pitch. The surrounding walls and floor are protected from splashing, and the walls and ceiling from the tarry matter, which may be carried up

with the fumes. Under the American Regulations the proportions of the reagents required for the generation of the gas are: 1 ounce of sodium cyanide, 1½ ounces of commercial sulphuric acid, and 2 fluid ounces of water. For ordinary fumigation for the destruction of rodents five ounces of sodium cyanide are laid down for each 1,000 cubic feet, the exposure being two hours. The requisite amount of water is first poured into the containers, the acid is slowly added, and finally when everything is ready, the sodium cyanide is added, either being dropped by hand or lowered by a string or placed in some form of tipping device which can be worked from a distance by pulling on a string or wire.

In the solution method it is recommended that 14 pounds of sodium cyanide be dissolved in 2¼ gallons of water and 7 pounds of sodium carbonate in 1¼ gallons, and the solutions run separately through funnels on deck connected to tubes leading to the barrels.

Properties of Hydrogen Cyanide: Physical.—The chief points to which attention is directed are the following: Hydrogen cyanide when pure is a colourless liquid with the odour of bitter almonds, and is more volatile than ethyl ether. Its density (air being taken as unity) is 0·94, and that of sulphur dioxide 2·23. The rate of diffusion is given as 1·03 (air as unity), and that of SO_2 0·68. It is pointed out that diffusion is a lengthy process, and that convection is probably the main factor in securing even concentration of the gas during fumigation. Again, in clearing the ship of the gas, reliance is placed not on diffusion but almost entirely on air currents—draughts through ports, assisted by windsails, windchutes, fans, aerothrust or compressed air.

Chemical.—Very small amounts of HCN may be absorbed by foodstuffs, particularly moist foods, but these will be rapidly evolved or oxidized on subsequent exposure to air or on cooking. Nevertheless it has been the practice to remove moist or liquid foodstuffs such as meat or milk before fumigation, and either to seal up or empty the fresh-water tanks.

Biological.—Experiments show that after inhalation of the gas a considerable period elapses between the onset of unconsciousness and death. Removal from the toxic atmosphere is usually followed by recovery and no after-effects. Animals vary in susceptibility, dogs being most strongly affected—1 in 3,000 being fatal in three minutes and 1 in 11,000 fatal in thirty minutes; 1 in 2,000 could be breathed by man for one and a half minutes without ill-effect.

American Quarantine Regulations (1920) specify the following strengths of the gas and duration of exposure for the different kinds of vermin:—

	NaCN per 1,000 cub. ft.	Duration	Theoretical gas concentration
Mosquitoes	0·5 oz.	½ hour	1 in 4,372
Fleas	2·5 ,,	½ ,,	1 ,, 874
Rats and mice	5 ,,	2 hours	1 ,, 437
Lice	10 ,,	2 ,,	1 ,, 218
Bed bugs	5 ,,	1 hour	1 ,, 437

Eggs are far more resistant than insects, and to secure complete destruction

of vermin it may be necessary to carry out a second fumigation after a lapse of time slightly greater than the incubation period.

Tests for the Presence of Hydrogen Cyanide.—The authors consider smell as a test of presence of HCN to be absolutely unreliable.

Chemical tests are not sufficiently rapid, simple, or efficacious for use on board ship. Two methods are described. It is shown that by far the most reliable method of determining whether all parts of the ship are free from gas is by the use of small animals, e.g., rats, mice, cats, or possibly birds. No part of the ship should be declared free until a cage has been lowered into it and the animal found unaffected after at least ten minutes.

Samples may be collected of the air in the interior during fumigation by aspiration through tubes leading outside or by means of vacuum sample bottles placed inside before the commencement of the process, and opened during the process by an electrical method or by a simple cord device.

Steps in Fumigation.—The following procedure is recommended:—

(1) *Inspect the ship and plan fumigation,* noting places where gas is likely to "pocket" for subsequent ventilation and testing. Do not fumigate if vessel is lying alongside another with anyone aboard. Also arrange for control of quay side. Get riggers and carpenters to close up openings after putting fumigating plant in position. Close ports, paper over doors, (which should *not* be locked), etc., fix ropes to door handles, ventilator covers, hatch tarpaulins, etc., so that they can be pulled off from quay side. Doors of cupboard, drawers, etc., to be as open as possible. Pipe casing should be opened from one end of ship to the other, and a certain number of lumber boards removed to allow penetration of the gas into the bilges. Lifeboats and poop deck require special attention. Liquids used for drinking and moist foods should be removed. Refrigerating rooms and engine rooms seldom require treatment, and should be separated off, if not to be treated.

Give as much notice as possible, and warn all by notices of the results of remaining on board.

Obtain a certificate from the responsible officer of the ship, and if shore hands have been on board, from their employer, that all men have been accounted for and their safety assured, etc. Remember possibility of stowaways and members of crew asleep.

(2) Charge plant, seal any openings left open, and leave the vessel for two hours (or period decided on).

(3) Open up the ship systematically from leaward to windward and from highest point to lowest, adjust windchutes, etc. Aerothrust, fans, etc., may be utilized. Operators then enter, but never until an hour has elapsed, and even then with all precautions, test animals, and oxygen breathing apparatus. Get the engine room free first. When the vessel is free, give certificate to that effect.

Disposal of Residue.—There is no residue with the liquid acid or with "Cyklon." In other cases cover the residue in the barrels with ½-inch fuel

oil (gas masks being worn by operators the while) and dump into the harbour or out at sea if volume of water in harbour is insufficient.

Accidents. — It is pointed out that danger from the use of HCN can be reduced to a minimum by careful precautions maintained throughout the entire process, and that accidents, when they do occur, are due to carelessness either when the gas is being generated, or while fumigation is in process, or when opening up and ventilating, or after the space dealt with has been pronounced clear.

First Aid.—A warning is issued against allowing anyone to proceed to rescue a comrade who has been overcome by the fumes unless provided with a mask or at least a life line.

Precautions.—The main precautions on which stress is laid are the following: Strong acid and cyanide should not be stored side by side. Trained personnel only should be employed, and these should be supplied with rubber gloves and effective respirators. Of these latter two types are recommended, the self-contained oxygen breathing apparatus which should be used between decks, and an apparatus similar to the Army gas mask, which should be worn by the personnel at all other times during the process. Warning notices should be posted, the ship searched, no unauthorized person allowed on board, a tally kept on gangway and a certificate obtained from officer in charge *re* his men. Charges should be fired and later vents should be opened from leeward to windward and from above downwards. Operators should work in pairs at least and the use of the life line should be borne in mind.

Summary.—There is no doubt in the author's mind as to the efficacy of HCN fumigation if properly carried out, nor as to the danger unless every precaution is taken. A system of licensing is insisted upon and hopes are held out that cyanogen chloride will shortly replace hydrogen cyanide as a fumigant.

In a foreword Sir George Newman suggests further inquiry be directed to the following points :—

"Pocketing"—lingering in dangerous concentration.

Properties of diffusion in various conditions of atmospheric temperature and humidity.

Ship construction to render rat harbourage impossible and rat destruction unnecessary.

Appendices follow on the undermentioned subjects :—

(1) By-laws of Town Council of Johannesburg in regard to the work or trade of disinfection by cyanide.

(2) Circulars to masters and agents of vessels regarding fumigation at the Port of New York.

(3) Outline of routine adopted for fumigation of ships at New York.

(4) Forms of certificate used in U.S.

(5) Australian apparatus for fumigating with hydrogen cyanide, attached to standard stock disinfectors.

(6) First-aid treatment of cyanide poisoning.

(7) Cyanogen chloride gas mixture—amendment No. 6 to the United States Quarantine Regulations.

The pamplet is liberally illustrated and contains photographs of the actual operations in progress.

Reviews.

History of the Great War. Medical Services. Diseases of the War. Vol. II. H.M. Stationery Office. Price £1 5s. 0d. Obtainable at H.M. Stationery Office, Imperial House, Kingsway, London, W.C.2, or Messrs. Thacker, Spink & Co., Calcutta and Simla.

It depends upon the point of view taken but there are reasons for saying that this volume constitutes the most important of the series. As a narrative of new problems that arose in the course of the Great War its importance can hardly be over-estimated, and considered as an introduction to medical problems that are entirely new and owe their origin to the war this volume is bound to take its place as a primary work of reference.

It deals with Neurasthenia (Chap. I), Skin Diseases (Chap. II), Venereal Diseases (Chap. III), Aviation (Chaps. IV-VI), Gas Warfare (Chaps. VII-XVII), and Medical Problems in Tanks (Chap. XVIII), and in Mines (Chaps. XIX-XXI).

That it has been possible to place on record so valuable a contribution to military medical science is a matter for congratulation to the Editors.

The list of contributors, experts with great practical experience of their subjects, at once disarms criticism.

Indeed criticism seems out of place when it is considered that we are not dealing with a textbook but with a narrative of war events collected from many sources and with considerable pains.

It would therefore appear to be the duty of a reviewer to give as brief an account of the contents of this volume as is consistent with his object, viz., to stimulate the officers of the Royal Army Medical Corps to read this volume thereby adding to their knowledge and consolidating their war experience.

Neurasthenia (Chap. I).—The effects on the nervous system of the strain, stress and exhaustion of modern warfare are emphasized by the fact that at the beginning of 1921, 65,000 pensioners were suffering from neurasthenic disablement and 50,000 at the beginning of 1922.

The gradual recognition of the disability in France, the building up of the organization necessary to deal with the increasing sick, the introduction of the much abused term "shell shock" with its evil consequences, and the opening up of neurological centres for diagnosis, treatment and disposal are points in an interesting story which lead up to a discussion on the ætiology of nervous diseases in war.

The symptoms, treatment, diagnosis and prognosis are adequately described and the general results of experience in France are summarized under seven headings.

The latter part of the chapter deals with nervous diseases as observed in the United Kingdom, and its interest is enhanced by the descriptions given of individual cases.

Finally, the subject of prevention is discussed in the light of the report of the Committee on Shell Shock which appeared after this chapter was in print.

Skin Diseases.—In the second chapter the importance of parasitic infections—scabies and pediculosis—as causes of wastage in time of war is clearly set out. Enormous wastage was caused by the failure to recognize the causes of pyodermia, 64·9 per cent of which was due to scabies. Wrong diagnosis accounted for much of the neglect which resulted in the affection becoming extremely resistant to treatment; whereas scabies in its early stages should be cured in three to four days, the average stay in hospital for severe or neglected cases was 31·7 days.

The predominance of pediculosis with its sequel, I.C.T., was the special feature of the forward areas.

The two parasites are described and comparison is drawn between the clinical appearances of the two infections.

The section is illustrated with charts, a coloured plate and a woodcut.

A section on Oriental Sore is in the main a narrative of its occurrence in Mesopotamia, and the various methods of treatment adopted are summarized, but a clear statement as to the best method in the light of the experience collected would have been of value.

In the last section of this chapter a short description is given of various forms of tropical skin diseases that were prominent in causing temporary inefficiency and even invaliding.

Venereal Diseases (Chapter III).—That the incidence of venereal disease in the whole British Army, including Dominion Forces, during the war actually compared favourably with that of the British Army during the three years previous to the war, does not alter the fact that from August 4, 1914, to November 11, 1918, in the British Forces, approximately 400,000 cases of venereal disease were treated.

A very full discussion on the various measures of prevention terminates with the conclusion that two measures, operating on the prevention of wastage by reason of admission to hospital, stand out as having given good results: (*a*) disinfection by skilled attendants; and (*b*) abortive treatment of gonorrhœa; and these measures must be given full consideration in the preparation for future wars.

The total number of beds set apart for the treatment of venereal disease reached approximately 23,900, and in recognition of the importance of efficient organization in treatment, considerable space is allotted to a description of No. 9 Stationary (later 39th General) Hospital, the parent hospital in France on which others were modelled.

The treatment of syphilis has now reached a high pitch of efficiency, and the steps leading up to the present scheme of treatment are well described. The problem of devising a course of arsenic treatment combined with mercury which should be effective in preventing relapses and at the same time non-toxic to the patient would appear to be well on the way to being solved.

The history of the treatment of gonorrhœa, on the other hand, is a disappointing one and is briefly summarized in the sentence : "The present solution of the gonorrhœa problem lies in treatment at the earliest moment."

The chapter ends with a list of suggested principles for determining a venereal disease policy in war. Let us hope as the result of recent developments in the treatment of gonorrhœa these principles will be capable of modification.

Aviation.—The development of flying and the necessity for training large numbers of pilots brought us face to face with psychological and physiological problems bearing on the physical fitness of candidates and the causes of breakdown. How these problems were tackled and the gradual evolution of tests for flying efficiency and for flying strain are related in Chapters IV, V and VI.

These chapters make most interesting reading, and the many ingenious tests devised for vision, for vestibular and nervous stability, for circulatory and respiratory efficiency warrant the closest study and attention. The necessity for oxygen supply when flying at great heights was a problem presenting the greatest difficulties, but was very successfully overcome.

Gas Warfare.—No less than eleven of the chapters are devoted to gas warfare. These chapters undoubtedly constitute the most important portion of the volume, forming as they do a record of this new type of warfare, from the day in April, 1915, when the first gas offensive was suddenly sprung upon us by the Germans up to the end of the war.

To give a lucid account of the development of gas warfare in all its aspects, chemical, medical, tactical and administrative, is a huge task. By dividing up the subject into chapters each dealing with a different aspect the whole ground has been successfully covered and in such a way that a clear consecutive and chronological picture of the whole subject can be formed. A certain amount of repetition is inevitable in such a scheme, but a degree of redundancy is essential to a lucid narrative.

The initial advantage obtained by the Germans and the difficulties experienced by the Allies in consolidating methods of production were a long time being overcome (Chapter VII), but meanwhile the success attending the defensive measures adopted by the Allies had a counterbalancing effect.

In the course of the campaign and as the effect of different gases with very varying properties came to be experienced, the tactical use of gas as an offensive weapon was elaborated. This tactical use had a direct relation to the specific chemical properties and physiological effects of any given gas,

and hence the importance of accurate knowledge of the characteristics, classification, and best method of employing a given gas in the field (Chapter VIII). It was ultimately realized that the effectiveness of offensive gas depended more on casualty production and temporary disablement than on lethal power. In Chapter IX the history of the use of gas as an offensive weapon by the Germans is sketched in detail, and to simplify description is divided up into periods, e.g.:—

(1) Chlorine (cloud), April, May, 1915.
(2) Lachrymators (shell), April, 1915 to July, 1916.
(3) Chlorine and phosgene (cloud), December, 1915 to August, 1916.
(4) Phosgene, etc. (lethal shell period), July, 1916 to July, 1917.
(5) Mustard gas period (shell), July, 1917, to end of war.
(6) Phosgene, chlorarsine, etc. (projectors), December, 1917 to May, 1918.

Each period is carefully described, detailed descriptions of actual attacks are given with resulting casualties and the means of protection in use by our troops at the time.

The growth and development through many vicissitudes of an organization to deal with the gas problem is effectively told in Chapter X. To institute defensive measures and devise protective appliances immediately became a matter of the greatest urgency, and on the Medical Services devolved this responsibility.

In England, until the formation of the Chemical Warfare Department in October, 1917, the responsibility for the production of protective appliances, respirators, etc., rested with the Anti-gas Committee under the Director General, Army Medical Service.

In France, an officer of the R.A.M.C. was made responsible under the Adjutant-General for all anti-gas defence until the formation, in March, 1916, of the Directorate of Gas Services under the General Staff. From this time the medical service in France became responsible only for the handling and treatment of gas casualties and was linked for this purpose to the defensive branch of the Directorate.

The most interesting part of this chapter, however, is that describing the development of protection for the individual. From the crude improvised respirator of the handkerchief and stocking variety to the latest pattern of small box respirator is a record of ingenuity in the application of chemistry, physics and mechanics, but the special achievement was the anticipatory production of a type of respirator which afforded protection against phosgene and then particulate clouds (e.g., chlorarsine) in time to frustrate the German attacks with these substances.

The purely medical aspect of gas warfare, the pathology, symptoms and treatment of the various poisonous gases is dealt with in detail in Chapters XI, XII, XIII and XIV.

Each group is discussed separately, e.g., acute lung irritants, vesicants, lachrymators, paralysants and sensory irritants.

A chapter is devoted to the pathology of acute lung irritants, phosgene being the most important. The important physiological problems arising as the result of the lung lesions are discussed in a masterly way and a thorough appreciation of these problems is an essential preliminary to a comprehension of the symptoms and treatment with which the following chapter deals.

Mustard gas was responsible for seventy to eighty per cent of the total gas casualties in the later stages of the war. Its importance as a tactical agent, as a producer of casualties combined with the inadequacy of protective measures, gives this gas pride of place as an offensive weapon. The advent of this most potent weapon has brought us face to face with problems, chemical, physiological, pathological and therapeutical, so elusive and still so far from being understood that the study of mustard gas becomes one of the most urgent items of peace time research. It may be said that we have made practically no advance in our knowledge of these problems since the end of the war, and in Chapter XII will be found the most complete description yet published.

An account of lachrymators, paralysants and sensory irritants is given in Chapter XIV. The value of arsenic compounds lies in their power to produce violent sensory irritation, and their tactical importance lies in the production of immediate disability.

The foregoing chapters on gas are illustrated by a few very good coloured plates and diagrams, but it is a pity that it was not possible to add still further to their value by more illustrations.

After a description of poisonous gases met with in the course of certain operations, more or less accidental and not used for offensive purposes, we come to Chapter XVI on the Handling of Gas Casualties. From the medical administration point of view this is a most important chapter and should be studied. The French and the American organizations are given for comparison and there is a short note on the German.

Invalidism from gas poisoning is discussed in the next chapter. The total casualties numbered 180,983 with 6,062 deaths. Since many men suffered from two or more exposures it is reckoned that 150,000 approximately represents the number surviving at the end of the war; twelve per cent of these (e.g., 19,000) were drawing disability pensions in 1920, but the percentage disability was low, on the average twenty. Few cases were seriously crippled. Neurasthenia, debility, D.A.H. and bronchitis were the main sequelæ. It should be noted that contrary to our expectations, the after-effects of gas are comparatively slight. Such records as are given are quite definite on this point and continue to be supported by reports from other sources which are now appearing.

Tanks.—Defects in ventilation were responsible for a curious train of symptoms which sometimes so severely affected the crew that the tank was placed out of action. The symptoms could be attributed to leakage of carbon monoxide from the exhaust, overheating in a moist atmosphere and entrance of petrol fumes from leaking tanks.

Mining Warfare.—The problems of ventilation in mining warfare are not new, but in the late war the development of mines as instruments of offence and defence was carried to a pitch never before contemplated.

A very large personnel was required, extensive complicated systems were worked at a great depth, immense quantities of explosive material were used and the nature of the explosives used conduced to the formation of much gas.

In these circumstances it is not to be wondered at that casualties from gas poisoning began to assume alarming proportions.

Carbon monoxide was responsible for most of the casualties, and the nature of this gas, its insidiousness and lethal power combined with the physical difficulty of working in confined underground galleries rendered the operation of rescue most difficult and dangerous. This is all set forth in the last three chapters of the volume. One whole chapter is devoted to the physiology, symptoms, morbid anatomy and treatment of carbon monoxide poisoning and another to Mine Rescue Work. The Proto and the Salvus apparatus with which rescue men are equipped and the modified Novita apparatus for the therapeutic administration of oxygen are illustrated and described.

The above brief summary shows that the gas problem in different aspects bulks largely in this volume. Actually in a total of 605 pages, 392 deal exclusively with gas poisoning or respiratory problems due to want of oxygen. This must give food for reflection, and the lesson to be learned is obvious, namely, that for the future we must develop research on the lines indicated in these pages. J. C. K.

Diseases of the Male Organs of Generation. By Kenneth M. Walker, F.R.C.S., M.A., M.B., B.C. London: Henry Frowde and Hodder and Stoughton, 1923, pp. xii and 234. Price 12s. 6d.

This excellent little book is something of a new departure as it deals with the diseases of the male organs of generation but excludes venereal disease, and only deals with affections of the urinary tract when it is directly involved in disease with the organs of generation.

The book is not designed for the practising surgeon but for the student and general practitioner, although the former will find many valuable hints in the book.

Affections of the prostate gland occupy sixty-eight pages and the present position of the surgery of the prostate is clearly presented.

The short chapter on genital tuberculosis is well worth perusal.

There is nothing very original in the chapters on hydroceles and hæmatoceles or on lesions of the spermatic cord, but the subject is clearly and concisely presented.

The gloomy prognosis of malignant new growths of the testicle is emphasized, and it is stated that after castration and removal of the cord as far as the internal ring the ultimate mortality is 100 per cent.

The last two chapters on sterility in the male and sexual neuroses are particularly well written and very interesting.

The little book is written in an interesting and readable manner, excellently printed and produced, with a large number of illustrations and diagrams.

There is a short but good index.

TWO LECTURES ON GASTRIC AND DUODENAL ULCERS: A RECORD OF TEN YEARS' EXPERIENCE. By Sir Berkeley Moynihan. Bristol: John Wright and Sons, Ltd. London: Simpkin, Marshall, Hamilton, Kent and Co., Ltd. New York: William Wood and Co. 1923. Pp. 48. Price 2s. 6d.

These two lectures present in a most pleasant and convincing manner the present position of our knowledge on the surgery of gastric and duodenal ulcers.

For much of the progress that has been made in the surgery of these affections we are indebted to the author, and it is most interesting to observe how his methods changed as knowledge grew. This knowledge was largely brought about by what he has termed a study of the pathology of the living.

Although he gives full credit to the physician yet the whole subject matter leaves the reader in no doubt that the sufferer from gastric or duodenal ulcer which has not rapidly and permanently yielded to medical treatment should be dealt with surgically.

The figures quoted show that the actual mortality is much higher if purely medical treatment is relied on than if surgical operation is performed.

Attention is particularly directed to the careful pre-operative treatment of these cases, especially to the necessity of eliminating oral sepsis.

The question of the effect of smoking on the free acid in the gastric juice and the importance of giving up the use of tobacco for a time at least after operation is clearly proved by three charts.

These two lectures should be in the hands of all surgeons and more particularly in the hands of all physicians.

The pleasure and profit of reading them is only exceeded by hearing the distinguished author deliver the lectures.

SURGICAL NURSING AND AFTER-TREATMENT. A Handbook for Nurses and others, by H. C. Rutherford Darling, M.D., M.S.London, F.R.C.S.England, F.R.P.S.Glasgow, Surgeon Coast Hospital, Sydney, N.S.W., Demonstrator of Anatomy, Sydney University. Second Edition. London: C. J. A. Churchill. 8s. 6d. net.

This book, now in its second edition, has been revised, certain chapters re-written and much new matter added.

It is published in a convenient size, well illustrated, the paper and type are good. It contains much useful information for nurses, and the

importance of the nurse having a good knowledge of the principles of modern surgical treatment has been kept well in view. From the title one would expect to find the details of surgical nursing more fully dealt with. It is noticed that in the chapter on fractures no mention is made of fractures of the skull.

The book is written in accordance with the syllabus laid down for the final examination of the Australian Trained Nurses Association.

FIELD AMBULANCE ORGANIZATION AND ADMINISTRATION. By Lieutenant-Colonel G. J. Hardie Neil, D.S.O., N.Z.M.C. London: H. K. Lewis and Co., Ltd. Pp. 125.

We welcome this book written by a brother officer overseas whilst on service with a field ambulance. It will be read with interest by every past field ambulance commander and should prove of the greatest value to anyone holding this appointment.

The book embodies the author's experience gained in war, and is therefore essentially practical.

The chapters on the training of the personnel and on the functions and interior economy of a field ambulance are excellent.

Considerable detail is devoted to the clerical work of a field ambulance and to the quartermaster's department, whilst much valuable information will be found in the chapters dealing with duties of personnel, the work of rest stations, advance dressing stations, etc.

The book is conveniently portable, and can be strongly recommended not only to all officers, but to all W.O.s and N.C.O.s of the Corps. It is a distinct contribution to the medical literature of the war.

Notices.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts, and commands at home and abroad.

All such Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notified at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Any demand for *reprints, additional to the above*, or for excerpts must be forwarded at the time of submission of the article for publication.

Matter intended for the Corps News should reach the Editor not later than the 15th of each month for the following month's issue. Notices of Births, Marriages, and Deaths are inserted free of charge to subscribers. All these communications should be written upon one side of the paper only; they should by preference be type-written; but, if not, all proper names should be written in capital letters (or printed) to avoid mistakes, and be addressed: The Editor, "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS," War Office, Whitehall, S.W.1.

MANAGER'S NOTICES.

The JOURNAL OF THE ROYAL ARMY MEDICAL CORPS is published monthly, a volume commencing on 1st July and 1st January of each year.

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Single copies can be obtained at the rate of 2s. per copy.

The Corps News Supplement is also issued separately from the Journal, and can be subscribed for at the rate of 4s. (four shillings) per annum, including postage. All subscriptions are payable in advance.

Subcriptions for the Corps News Supplement separate from the Journal cannot be accepted from Officers on the Active List unless they are also subscribing to the Journal.

Single copies can be obtained at the rate of 6d. per copy, excluding postage.

Cheques or Postal Orders for Subscriptions, etc., should be made payable to the "Hon. Manager, Journal R.A.M.C." and crossed "Holt & Co."

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Original Communications.

THE EXAMINATION OF MAJORS, R.A.M.C., FOR PROMOTION TO LIEUTENANT-COLONEL, APPENDIX X, KING'S REGULATIONS.

BY COLONEL R. S. HANNAY, C.M.G., D.S.O.

THE difficulties which Majors R.A.M.C. have to overcome in studying for the examination laid down in Appendix X, K.R., Part II, have been so frequently brought to notice during the present year, that the following notes on Medical-Appreciation writing may prove of use.

No textbooks are available and the experience of individual officers has been so unequal, that some assistance appears to be necessary.

The examination itself varies in character and requirements in different commands at home and abroad. Major-General Guise Moores, C.B., C.M.G., has published a fully worked-out Medical Staff Tour held in the Aldershot Area, which supplies to candidates a most valuable guide. The following notes on Appreciation writing in the Eastern Command in 1923 are submitted.

It is hoped that those who read them will clearly understand that the object is to present one scheme, of the many suitable for Appreciation writing, which can be easily altered by the individual candidate from the broad outlines presented. An example is given from the actual problem set in July, 1923.

R.A.M.C. TRAINING, 1923.

THE MEDICAL APPRECIATION OF A SITUATION.

Appendix X, K.R., 1923, lays down that the Medical Appreciation of a Situation shall form one of the exercises in Part II (Practical) Examination of Majors R.A.M.C. for promotion to Lieutenant-Colonel. Recent

examination experience has shown that the majority of field officers of the Corps find an appreciation extremely difficult to write. However, practice in writing them will amply repay the trouble taken, as this teaches senior officers their duties in the field, and so enables them to formulate a scheme of medical arrangements which will fit in with the general plan of operations of the Army under varied conditions of service. The value of the preparation of Appreciations was realized by many officers who suddenly found themselves in administrative positions during the latter part of the Great War.

It is hoped that the following explanation of the Eastern Command notes on Appreciation writing may assist those about to enter for the last examination test of their career.

What is a Medical Appreciation?

It is a military medical expert's reasoned forecast of the medical factors, problems and necessities of a military campaign, for the assistance of the Staff in making provision for and conducting the campaign.

The two most important duties of a military medical expert in a campaign are:—

(1) The maintenance of the fighting strength of the troops by: (*a*) the prevention of disease; (*b*) the speedy return to the ranks of the wounded and sick.

(2) The maintenance of the moral of the force by: (*a*) advice as to general well-being of the Force; (*b*) ensuring such a high standard of efficiency in the medical services that the excellence of the care of the sick and wounded is obvious to all.

A little reflection will show the many medical factors which bear on these two duties.

Preventive inoculation against certain diseases, extreme hygenic efficiency, clothing, baths, food, water, dental facilities, anti-venereal measures, comfort and care of the sick and wounded, etc., are intimately connected with obtaining the most out of a soldier. Over-loaded and over-marched men cannot exploit a success, nor can a mixture of high and low grade categories form a good fighting unit. The advice of a medical expert is of great value in man power questions in order that the maximum of work may be obtained with the minimum of wastage.

Having mentally turned over and expanded the foregoing ideas, let us proceed from the general to the particular, and start our Appreciation.

The narrative supplied should be carefully memorized and followed out on the maps.

Then a minute survey of the country should be made by visualizing the ports, railways, rivers, waterways, roads and towns from disembarkation points to concentration areas. A mental picture of the topography of the country is essential to the satisfactory siting of the base and line of communication portions of the chain of evacuation.

The notes on Appreciation writing which have been made out will now be discussed in detail.

The heading of work should be: "Medical Appreciation of the Situation by R.A.M.C." *"Secret."*

Reference O.S. Maps .

(1) *Estimate of the Possible Strength of the Opposing Forces.*

(*a*) Your own forces: Its probable bases, lines of communication and present situation and location.

War establishments give you the strength of divisions, etc. For lines of communication units, base troops, air force, etc., any reasonable figure may be assumed, i.e., for the present expeditionary force of one cavalry and three infantry divisions, about an additional 6,000 may be taken to represent the above.

It is well to say: "Information from the War Office gives the strength as . A reasonable assumption is always accepted. The visualization of the maps supplied with the information in the narrative, gives the answer to the present situation and location of the lines of communication. Railway lines, etc., can be stated as allowed by the Staff.

(*b*) *Allies.*—Their general state of readiness including strength; their moral; their medical arrangements (if known); condition of their services.

Here again you should try to realize the meaning of the narrative and whether it is applicable to present-day conditions. Once this is done, boldly assume information as given by general headquarters.

(*c*) *Opposing Forces.*—Their strength, armament, state of moral, and services. Same applies as in (*b*).

A recent situation set at an examination obviously was based on the recent events in Turkey. *a*, *b*, *c*, are commonly placed under the heading "Information," and are made up of a précis of the narrative plus the figures obtained from the war establishments, or assumed.

(2) *Intention and policy*, if known, of your own forces.

These again are contained in the narrative supplied. The "Military information" and "intention" should only give you the bare outlines which it is necessary for the medical expert to state as the basis for subsequent deductions.

(3) *Medical Arrangements.*

State the broad outlines of your own methods for dealing with the wounded and sick of your own force. Such points as accommodation for:—

Gas Cases,	Sick Officers,
Infectious Cases,	Nursing Sisters,
Venereal ,,	Prisoners of War,
Rabies ,,	Allied Troops,
Friendly Civilians,	Hostile Civilians,

should be considered where applicable.

Note all forms of known auxiliary medical services that are expected to assist.

If the narrative is taken to apply to European countries, such auxiliary medical services as the Red Cross Society, Voluntary Aid Detachments, etc., should be borne in mind.

(4) *Topographical Influence on the Campaign.*

(*a*) Consider the country in which operations will take place: roads, railways, waterways, water supplies, towns and villages, hills, woods, deserts and cultivation. If a true visualization of the maps supplied has been made, no difficulty should be experienced in this respect.

(*b*) *Supplies.*—Local resources of the country; period of harvest.

(*c*) *Civil Population.*—Estimate numbers roughly, whether friendly or otherwise.

(*d*) *Climatic Conditions.*—Extremes of heat and cold in sub-tropical countries should specially be noted.

(*e*) *Prevalent Diseases.*—These should include all the prevalent diseases of the country and the periods of the year during which they occur. The duration of the campaign is a factor to be carefully considered in writing the answer to the above, as the whole period should be covered. Such diseases as rabies and heat-stroke should be thought of, if the campaign is in a sub-tropical country.

(5) Estimate the class of wounds likely to have to be dealt with in view of the enemy's armament. The narrative usually states the nature of this armament; if it does not, assume and state that the staff have given this information.

Heavy artillery and aeroplanes will materially increase H.E. shell and bomb injuries.

(6) The effects of a long campaign on the health and moral of the troops.

This note explains itself and needs no comment.

(7) *Casualties.*—As regards the battle casualties, ten per cent of three-fifths of the Forces may be used as a provisional working basis: but in estimating numbers, the nature of the warfare, weapons being used, etc., must be taken into consideration. The General Staff will advise on this matter.

Estimate the number of beds required in base hospitals, which should include requirements for nursing staff, allies and prisoners of war, etc.

Estimate the sick rate at various periods of the year, based on the climate and length of campaign.

A calculation should be made showing accommodation required in hospitals within the sphere of operations. This will enable the probable reinforcements to be worked out. State the period for which you consider they should be retained in local hospitals before evacuation to home bases.

A clear picture should be given of the means you require and intend to utilize to transport these casualties to the home bases.

In calculating hospital accommodation required, the following scheme is suggested:—

Wounded.—(*a*) Assume 10 per cent of three-fifths of the force are battle casualties; (*b*) of this number, 20 per cent killed or missing; (*c*) of the remainder, 10 per cent will not require admission to hospital, being returned to units or retained in Field Ambulances; (*d*) assume 30 per cent of wounded will require evacuation by hospital ships to England.

Sick.—For operations in the Near East where malaria and sandfly fever are prevalent, calculate on at least 5·5 per 1,000 being admitted to hospital each day, or 110 per division of 20,000.

Of these assume that: 40 per cent are discharged from hospital in seven days; 50 per cent require three weeks hospital treatment; 10 per cent are invalided.

The number of beds required depends not only on local conditions and prevalence of disease, use of gas, etc., but on facilities for evacuation to, and distance of bases from home territory.

It is advisable to hold a reserve of fifty per cent in addition to the above estimate to meet unforeseen casualties, and sick.

It must be understood that the estimates given above are not based on actual statistics of the Great War, no such statistics being available yet. It is, however, necessary in every case to show the percentages which have been assumed under the various headings so that they can be readily checked and amended if necessary.

Day	Admissions	Discharged	Evacuations	Remaining
1	200	—	—	200
2	200	—	—	400
3	200	—	—	600
4	200	—	—	800
5	200	—	—	1,000
6	200	—	—	1,200
7	200	80	—	1,320
8	200	80	—	1,440
9	200	80	—	1,560
10	200	80	20	1,660
11	200	80	20	1,760
12	200	80	20	1,860
13	200	80	20	1,960
14	200	80	20	2,060
15	200	80	20	2,160
16	200	80	20	2,260
17	200	80	20	2,360
18	200	80	20	2,460
19	200	80	20	2,560
20	200	80	20	2,660
21	200	180	20	2,660
22	200	180	20	2,660

The above table seems perfectly clear, but remember that a calculation should be given taking the period stated as the average stay in hospital, i.e., thirty-one days, and showing day by day for twenty-one days the admissions, evacuations and remainings, so that proof of the statement of accommodation required may be given.

The hospital bed figure for sick alone is therefore 2,660 for a force of 80,000 with a daily sick rate of 2·5 per 1,000 admissions. In addition to the figure for the sick 10 per cent of three-fifths of 80,000 as battle casualties gives 4,800, less 20 per cent killed or missing, and 10 per cent not requiring admission to hospital, viz., 3,456 beds will be required for the accommodation of wounded. The total bed accommodation is therefore :—

Sick	2,660
Wounded	3,456
Fifty per cent Reserve	3,058
	9,174

This figure is nearly 11½ per cent of the force and does not include prisoners of war, help to allies, Navy, allied or enemy civilians. In a subtropical or tropical country it should be increased to 12 or 15 per cent of the total number of the troops.

(8) *Present Distribution of Medical Units.*—A little imagination will enable the base line of communication units to be sited and a reasonable assumption based on supposed information supplied by the Staff will always be accepted.

General hospitals should be at overseas bases of an expeditionary force, and until success is assured immobile units should not be pushed up the lines of communication unless they are required very urgently.

With modern motor and rail facilities, evacuation of sick and wounded is easy and rapid in European countries.

In estimating the number of hospital ships, the capacity per ship must be worked out in connexion with the number of trips possible per month.

It should be realized that a ship must periodically have a longer stay at a home port than is required for disembarking sick and wounded, in order to refit with stores, &c.

(9) *Summary.*

(*a*) Wastage.

(*b*) Evacuation.

(*c*) Consultants considered necessary.

(*d*) Red Cross Society.

(*e*) Any special recommendations which are considered necessary, which are not met by existing war establishments, i.e. :—

(i) Increase in number of medical units.

(ii) Modification of above.

(iii) Increase in number of hospital ships.

(iv) Modification of above.

(v) Modification of medical supplies that may be considered necessary from the climatic conditions.

The Summary should be terse.

It should be a tabulated statement of the medical requirements which the hard-worked staff can quickly understand. Explanations for increase or modifications which you consider necessary should be as concise as possible.

In order to show the practical application of these general principles, the following scheme of a staff tour, which was set for a recent examination, is given.

Eastern Command Medical Staff Tour Set for Examination in 1922.

Reference O.S. Map. Sheet 10, ¼ *inch to* 1 *mile. Sheet* 126, 1 *inch to* 1 *mile. Sheet* 39, ½ *inch to* 1 *mile.*

General Idea.

(1) Eastland is at war against Southland and Westland.

Midlands is a neutral power.

(2) Eastland comprises the counties of Norfolk, Suffolk, Essex and Kent.

She is a semi-civilized power of considerable fighting value and has modern armament for six divisions and one cavalry division. She has, however, no tanks and very few aeroplanes. In addition to regular troops she has considerable numbers of irregulars. She has no navy.

Southland comprises the counties of Sussex, Hants, Dorset, Somerset, Devon and Cornwall.

She has two divisions of fair fighting value and four disorganized and demoralized divisions. She has little equipment.

Westland is an overseas power with an available expeditionary force of six divisions and one cavalry brigade complete with all modern accessories.

Midlands comprises the remaining counties of England and consists of several small states hostile to both Southland and Eastland but friendly to Westland.

(3) The general climatic condition of the theatre of war and the general characteristics of its inhabitants may be considered to be similar to those of South Eastern Europe.

The time of the year is July.

The topographical conditions and general economic facilities will, however, be taken exactly as they exist on the ground.

CONFIDENTIAL.

NARRATIVE No. 1.

Eastland was defeated in a war against Southland and Westland and was deprived of her territory south of the Thames.

Westland then demobilized.

Southland subsequently endeavoured to extend her conquests north of the Thames but was heavily defeated by Eastland. The latter then re-occupied the county of Kent and part of Sussex.

Westland then remobilized and seized a base at Richborough near Sandwich.

The Midlands remained neutral and issued orders to their frontier troops to attack either Eastland or Southland troops who attempted to violate her neutrality.

The general plan of Westland and Southland is as follows:—

(1) To advance from Thanet on London with four Westland divisions and one Westland cavalry brigade (less one regiment). One Westland division being retained in its transports. The whole operation being supported by the Westland Navy in the River Thames.

(2) The Southland forces supported by one Westland division and one Westland cavalry regiment to advance on Gravesend so as to threaten the rear of Eastland forces in Kent.

The situation on July 11 is as follows:—

Westland. Two divisions on Margate—Canterbury—Chatham Road—head at Faversham. Two Divisions on Sandwich—Canterbury—Maidstone Road—head at Charing. One division still in transports.

Southland. Detachments on line Hastings—East Grimstead (remains of four divisions). One division about Uckfield. One division in reserve about Lewes.

One Westland division and one Westland cavalry regiment disembarked at Newhaven detrained at Haywards Heath, Wivelsfield and Burgess Hill, and is in billets as follows:—

1st Division Headquarters and cavalry regiment, Haywards Heath.

1st Infantry Brigade, Haywards Heath, west of L.B. and S.C. Railway and Cuckfield.

2nd Infantry Brigade, Haywards Heath, east of L.B. and S.C. Railway, and Lingfield.

3rd Infantry Brigade, Wivelsfield Green, Wivelsfield and World's End.

1st Division Artillery, Burgess Hill.

Supply railhead, Haywards Heath.

Eastland is in contact along the whole front with both Southland and Westland.

The detailed distribution of Eastland Divisions is not known.

Problem 1.

Required Medical Appreciation of the Situation from the point of view of D.M.S. Westland Expeditionary Force.

Westland's home base port may be taken as 1,000 miles from Dover.

SECRET. *E.C., No. 8/34071(G) dated 16.6.28.*

PROBLEM 1. MEDICAL APPRECIATION OF THE SITUATION BY MAJOR——— R.A.M.C., D.M.S., WESTLAND EXPEDITIONARY FORCE

Reference O.S. Maps. Sheets 10, ¼ *inch to* 1 *mile;* 39, ½ *inch. to* 1 mile, 126, 1 *inch to* 1 *mile.*

(1) *Information from Westland General Headquarters.*—(*a*) Westland Expeditionary Force consisting of six infantry divisions, one cavalry brigade, corps, army, lines of communication and base troops and Royal Air Force, is 150,000 strong. It is equipped with all modern military appliances, is well trained, disciplined and efficient with high moral. It has remobilized and again proceeded 1,000 miles overseas to aid its Southland Allies in their hour of need.

Two bases have been successfully occupied :—

" A " at Richborough (Kent), enemy country.

" B " at Newhaven (Sussex) in our Southland Allies country.

The 1st, 2nd, 3rd and 4th Infantry Divisions, 1st Cavalry Brigade (less one regiment) with necessary corps, army, lines of communication and base troops and quota of Royal Air Force have landed at Richborough. The 1st Corps of 1st and 2nd Divisions has reached Faversham while the head of the 2nd Corps of 3rd and 4th Divisions rests on Charing. Both corps are in touch with the enemy.

The 5th Division with ancillary units remains in transports at Richborough.

The 6th Division has landed at Newhaven with one cavalry regiment and necessary Royal Air Force and detrained at Haywards Heath. Its line of communication and base units have also disembarked and established themselves.

This division, with the two remaining Southland divisions, form the Southland Corps.

(*b*) Our allied forces consist of the above two divisions each 15,000 strong of fair fighting value and the remains of four disorganized divisions in touch with the enemy on the Hastings—East Grinstead line. Their administrative and ancillary services are poor.

Westland strength	150,000
Southland ,, ...	60,000
Total allied strength	210,000

(*c*) The enemy Eastland's forces consist of six infantry divisions each 15,000 strong and one cavalry division of 5,000. There are also irregulars estimated at 25,000.

Total enemy forces 110,000 of high moral owing to their recent victories over Southland.

The Regular Forces of Eastland are well trained and equipped, but

have no tanks, few aeroplanes and little heavy artillery. The administrative and ancillary services are very inferior.

Eastland has no Navy.

Our Navy is powerful and holds the seas.

(2) *Intention and Policy.*—The Allied Forces desire as short a campaign as possible to achieve their objects and secure a final, complete, and decisive victory.

"A" Force is to push the enemy towards the Thames. "B" Force is to roll up his flank and the Navy to co-operate from the Thames estuary.

(3) *Medical Arrangements.*—Westland on W.E. scale plus additional units specified in paragraph 7. An efficient Red Cross Society is available.

Southland.—Only divisional medical units to be relied on, but a Red Cross Society exists.

Eastland.—Medical services are badly equipped and organized with an indifferent Red Crescent Society. This is likely to have a serious effect on moral in case of defeat.

Full assistance must be given by us to Southland and the efficient Westland medical units so supplied will be an important factor in increasing and improving the moral of a recently defeated Army. These units are detailed in paragraph 7.

(4) *The Country.*—(*a*) The country is S.E. Europe as regards climate, but Kent and Sussex in England as regards topography. Kent is highly cultivated and open, with gardens and orchards. It is well-watered, with good metalled roads of generally easy gradients and numerous railways linking the towns and villages. The inhabitants are hostile and large numbers have fled on the advance of our troops. Sussex, in which the flanking attack is operating, is hilly, heavily wooded in parts and enclosed. Roads are good but gradients often fairly high. Railway communication is good. Buildings are of stone or brick and substantial. The inhabitants are allies and friendly.

(*b*) *Supplies.*—Local resources in Kent will be good at first, but poor later, owing to flight of inhabitants. In Sussex good throughout. The supply question presents no unusual difficulties. Efficient cold storage with liberal ice supply is essential.

(*c*) The civil population of Kent is hostile and numbers about 1,500,000. That of Sussex is friendly and numbers about 1,000,000.

(*d*) *Climatic Conditions.*—Sub-tropical with maximum of 95° F. in August and minimum of 70° F. The hot weather commences in July and lasts three months. Heavy thunderstorms with torrential rains occur periodically during this season. The intervening periods are hot, dusty and very dry. From December to the end of March, the climate is wet and very cold with snow and icy winds, with occasional blizzards. Sun helmets, khakhi drill clothing, etc., are required during six months of the year, while thick underclothing, khakhi serge and extra blankets, etc., are necessary in the cold weather.

(*e*) *Prevalent Diseases.*—Sandfly Fever : Inefficiency period three weeks, prevalent from mid-June to end of September. Incidence likely to be very high but can be lessened by use of sandfly nets (22-thread mesh) and keeping troops in the open.

Malaria : Chiefly occurs during September, October and early November. Incidence can be lessened by antimalaria work where possible and protection by nets, veils, gloves and mosquito deterrents.

Diarrhœa and Dysentery: Prevalent during August, September, October and November. Dysentery mostly Flexner type and usually not severe. Incidence can be lessened by washing raw fruits and salads before consumption and care in selecting source of supply; by anti-fly measures and cleanliness in handling and cooking food.

Typhus is practically endemic, but can be guarded against by frequent bathing and delousing, with disinfestation of billets, etc.

Cholera : Outbreaks are common in this country, being imported from further East. Inoculation is a valuable safeguard.

The troops are well protected by inoculation against the typhoid group and by vaccination against smallpox, but care in the periodic renewal of this protection is essential.

Venereal is likely to be high in the towns.

Rabies is common and a special unit is asked for, for anti-rabic treatment. Heat stroke will occur unless care is taken in march timings and to avoid all possible strain on the troops. Marches should be only in the cooler hours of the day.

A high sick-rate is to be expected in a campaign commencing in the hot weather of a sub-tropical country.

(5) Bullet wounds will predominate. Tetanus and gas gangrene will appear early, as the soil is highly manured. Our preponderance in strength and command of the sea should secure a short campaign. Prolonged operations will increase sick wastage and inefficiency to a marked degree.

(6) Long marches should be avoided and only water from approved sources consumed.

(7) *Casualties*—It is considered that all hospital admissions requiring over two months' treatment should be evacuated to home bases.

Wounded.—Battle casualties are estimated at ten per cent of three-fifths of the Force. In a general engagement this gives the total of 9,000 less 20 per cent killed—7,200 wounded as a maximum for one battle of the whole Force. Of this 7,200, 10 per cent, or 720, must be deducted for cases not requiring general hospital treatment. The total wounded on any given day for which bed accommodation must be available is therefore 6,480.

Sick.—The admission rate to general hospitals W.E.F. is estimated at 0·5 per cent, rising later (i.e., in six months) to one per cent. Therefore 750 cases will be admitted daily, of whom 40 per cent will be discharged in seven days, 50 per cent in twenty-one days, and 10 per cent invalided.

Day	Admissions	Discharges	Evacuations	Remaining
1	750	*Nil*	*Nil*	750
2	750	*Nil*	*Nil*	1,500
3	750	*Nil*	*Nil*	2,250
4	750	*Nil*	*Nil*	3,000
5	750	*Nil*	*Nil*	3,750
6	750	*Nil*	*Nil*	4,500
7	750	300	*Nil*	4,950
8	750	300	*Nil*	5,400
9	750	300	*Nil*	5,850
10	750	300	75	6,225
11	750	300	75	6,600
12	750	300	75	6,975
13	750	300	75	7,350
14	750	300	75	7,725
15	750	300	75	8,100
16	750	300	75	8,475
17	750	300	75	8,850
18	750	300	75	9,225
19	750	300	75	9,600
20	750	300	75	9,975
21	750	675	75	9,975

Therefore 9,975 is the accommodation required for constantly sick at 0·5 per cent from the twentieth day onwards.

Wounded beds	6,480
Sick beds	9,975
	16,455
Reserve beds	1,545
	18,000

Twelve per cent of the total strength is estimated as giving the number of hospital beds necessary, i.e., 18,000.

This figure has been arrived at for the following reasons :—

(*a*) The campaign commences in the hot weather of a subtropical country where sandfly fever, malaria, dysentery and other diseases are rife.

(*b*) The danger of epidemic disease, such as cholera, typhus and influenza.

(*c*) The obligation to care for the sick and wounded of the enemy whose medical arrangements are poor.

(*d*) The medical assistance needed by such civil inhabitants of Kent as may remain.

(*e*) The fact that our own Navy desires accommodation in our Military hospitals.

Beds available in W.E. Hospitals provided ..	10,800
Beds considered necessary	18,000
Deficit ...	7,200

Therefore six additional large general hospitals of 1,200 beds are required, with a convalescent camp to hold 2,000.

This accommodation will require a gradual increase to 24,000 beds as the sick rate rises in the next few months.

In addition to these our Southland Allies have stated the help needed by them to be :—

Two Casualty Clearing Stations.
Two 600-bedded General Hospitals.
Two 1,200-bedded General Hospitals.

The above to be complete with personnel and equipment.

The daily number of sick requiring hospital ship accommodation to home bases is ten per cent of 750, i.e., 75 per day or 2,250 per month. The three hospital ships of 700 beds supplied can only steam twelve miles per hour, so that each ship at her best will take three and a half days for the homeward, and three and a half for the outward voyage of one thousand miles. The maximum number of trips per month per ship is therefore three. That is, each ship can transport 2,100 cases home per month. Total evacuation of three ships, 6,300 cases. In addition, 1,944 wounded may require evacuation after any general engagement of the W.E.F.

(8) *Distribution of Medical Units.*—These are now established :—

No. 1, 2, 3 and 4 General Hospitals of 1,200 beds each at Richborough, of which No. 1 has fifty beds for nursing sisters.

No. 5 General Hospital of 1,200 beds at Brighton for Southland troops.

No. 6 General Hospital of 1,200 beds at Newhaven for the 6th Division W.E.F.

Nos. 7 and 8 General Hospitals of 600 beds each at Ramsgate.

Nos. 9 and 10 General Hospitals of 600 beds each at Margate, of which No. 9 is for infectious diseases, and No. 10 for venereal cases.

No. 11 General Hospital of 600 beds is still in transports in reserve.

No. 12 General Hospital of 600 beds is at Lewes.

Total beds " A " Force—7,200.

Total beds " B " Force W.E.F.—1,800.

In addition steps have been taken to render each 600-bedded hospital capable of expansion to 1,000 beds.

Casualty clearing stations have been opened at :—

Nos. 1 and 2 Canterbury and 3 and 4 at Chilham.

No. 5 in reserve in transports, No. 6 at Haywards Heath expanded to 1,000 beds by utilizing R.A.M.C. 1st line reinforcements from R.A.M.C. Depot, Richborough.

Each division has its own sanitary section, while sections are operating at the bases and on lines of communication.

Mobile laboratories accompany each Force.

Base depots medical stores have been opened at Richborough and Newhaven with one in reserve.

Advance depots of medical stores are at Canterbury and Haywards Heath, with one in reserve.

Convalescent camps have been opened at Broadstairs and Brighton of 2,000 beds each.

Dental Centres are at Richborough, Canterbury, Newhaven and Lewes.

One hospital ship is based on Newhaven.

Two hospital ships are based on Richborough.

Two M.A.C.s are allotted to "A" Force.

One M.A.C. is allotted to "B" Force.

Of these, two sections in each case fulfil Corps requirements, the remaining cars being allotted to the bases.

Two hospital trains function for "A" Force, one for "B."

SUMMARY.

(*a*) *Wastage.*—Wound and sickness wastage are probably thirty per cent of total wounded and ten per cent of total sick.

The likelihood of larger reinforcements than specified in war establishments for the administrative and ancillary services owing to the arduous and continuous nature of their duties in a sub-tropical climate should be borne in mind. This factor is particularly applicable to the Medical Services.

(*b*) *Evacuation.*—Presents no special difficulties, but an additional hospital ship should be provided at once.

(*c*) The following additional consultants are considered necessary:—

Three consulting surgeons.

Three consulting physicians.

Two mental specialists.

Four eye specialists.

Two ear, nose and throat specialists.

One entomologist.

(*d*) A Red Cross representative should be supplied for each corps and base with the chief director at general headquarters.

(*e*) A very high standard of efficiency in sanitation is essential to conserve the strength of the force and avoid wastage by preventable disease.

The draft orders forwarded to "A" Branch should be carried out thoroughly and steps taken to enforce them.

It is requested that the following be demanded by urgent cable from Westland War Office:—

Three special plants for ice making on a large scale.

One special anti-rabic unit.

Six general hospitals of 1,200 beds each.

One convalescent camp of 2,000 beds.

One (700 cot) hospital ship of 15 knots steaming power.

The above for our own Forces.

Two casualty clearing stations, two 600 bedded and two 1,200 bedded general hospitals complete with personnel.

One base depot medical stores complete with personnel for our Southland allies, to be consigned to Brighton.

That the requirements specified in the foregoing paragraphs (*c*) and (*d*) be demanded by letter, and that the necessity for the holding in immediate readiness for shipment from home bases of considerable stocks of quinine, sera and vaccines be represented.

G.H.Q.
W.E.F.

Major R.A.M.C.
D.M.S. W.D.F.

ON THE MODES OF PRODUCTION OF "RICKETTSIA"-BODIES IN THE LOUSE.

By H. M. WOODCOCK, D.Sc.Lond.
Fellow of University College.

(*Continued from p.* 131.)

"RICKETTSIA"-BODIES FROM NORMAL LICE.

As I pointed out in my previous paper [16], there was no reason to doubt, on my view of the nature of "Rickettsia"-bodies, that such would be found to occur, at any rate occasionally, in normal lice, "uninfected" with the virus of either typhus or trench-fever. A box of lice, obtained as stated in my introductory paragraph, was fed on myself daily without intermission (and usually twice daily) for over a month. During this period, the fine gauze, through the meshes of which the lice bit, was only once renewed, and each covering became considerably soiled with the excreta. The bites proved very irritating to me and a certain amount of scratching was unavoidable, so that now and again excoriation and bleeding occurred. Apart from this, however, I have not experienced the slightest inconvenience from the effects of these lice feeding on me. I desire to take this opportunity of thanking Dr. Arkwright very much for valuable hints and assistance in regard to keeping and feeding the lice.

The clean, unused box was started with ten or eleven lice, including both males and females. Eggs were laid, and in due time the young lice hatched out and in their turn fed. By about the middle of the third week all the original lice had died off and only small or medium-sized ones, of the new generation, were present.

My whole object was, of course, to confirm the statements already made by various workers that normal, healthy lice do contain "Rickettsias," and to see what these would prove to be like. Hence, for the most part, I contented myself with making preparations regularly from samples of the mass-excreta, shaken out of the box. On each occasion, all the loose excreta were removed. Three or four smears were thus made at a time, sometimes at daily intervals, at others every two or three days. Now and again, smears were made of the gut-contents of individual lice, and some of these also proved positive, thus placing beyond doubt that the bodies in question did come from the gut of the lice. After the event, I see that more information on one or two interesting points could have been gained had I followed a few individual lice separately, throughout the life-history.

"Rickettsia"-bodies, of one or more of the types to be described, were found in one or more of the smears made, on every occasion except the first time, when I took extremely little material and found nothing which I

could regard as definite, and once during the period when the original lice were nearly all dead and the new generation very young. I cannot say certainly that every louse would show the bodies, therefore, though I think it most probable that they all would, *at one period or another.* I have the impression that very young lice do not show them at first. Towards the end of the month, there were many more adult lice in the box (from twenty-five to thirty at least), than at the start, and the "Rickettsias" were much more readily found in the smears. This was probably because the excreta were more abundant and more material was put on each slide.

Portions of the dry excreta were allowed to fall out of the lid of the box (by gentle tapping), into droplets of salt-citrate solution or tap-water on the slide, and were then well rubbed about and broken up as much as possible with a needle. I found that it made no difference whether salt-citrate or tap-water was used. The drop was spread out a little and then allowed to dry thoroughly, being afterwards fixed in absolute alcohol for ten minutes and stained in the usual manner. The preparation was not otherwise treated in any way, my object being to see what was present in the excreta, *in as natural a form as possible.* That some blood in a condition very little altered is passed in the fæces, is apparent from the fact that, invariably, some yellow hæmoglobin-like substance is dissolved out, from the small, almost black particles of excreta, when these are moistened by the water. But the pigmentiferous residue of the complete digestion is preserved unaltered.

The general appearance of the smears, when examined, varies considerably, this being, again, dependent on the stage to which the digestion had been carried in the case of the particular sample of hæmatogenous material forming the preparation. If the digestion was practically complete, scarcely anything but pigmentiferous masses and clumps of grains, of all variety (as described in the first section above) would be present. If, on the other hand, hæmatogenous material in an earlier stage of digestion had been also excreted and formed part of the sample, altered blood, still recognizable as such, would be found. Red corpuscles, amorphous masses of hæmoglobin, resulting from a quantity of corpuscles having had their envelope dissolved and running together, black masses, and the same separating out into pigment grains—all these stages occur. And there is one important point to note. The more the preparation indicates that the sample of excreta consisted of blood in an early stage of digestion, the less likelihood is there of finding "Rickettsias." Conversely, the more the smear consists of well-defined pigment-grains the greater the number of clumps of such bodies. In my preparations I have not found any bacteria, and I must confess I regard the gut-contents of the louse as being, practically speaking, sterile.

The "Rickettsia"-bodies are always in clumps or aggregations; sometimes very dense, but at other times more scattered, having possibly been separated a little in making the preparation. They can never be found

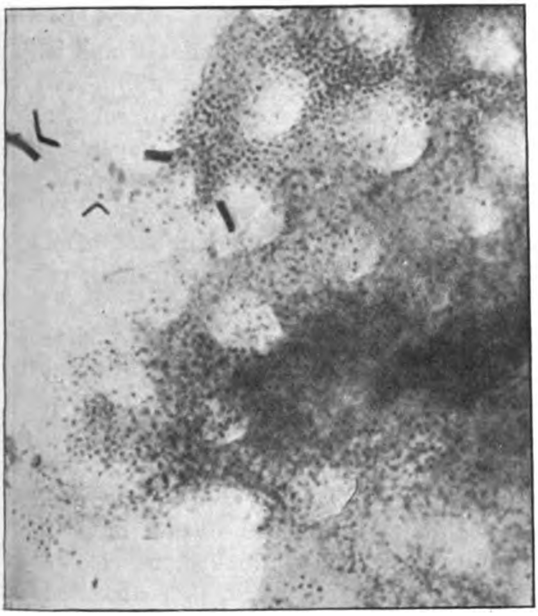

Fig. 20.

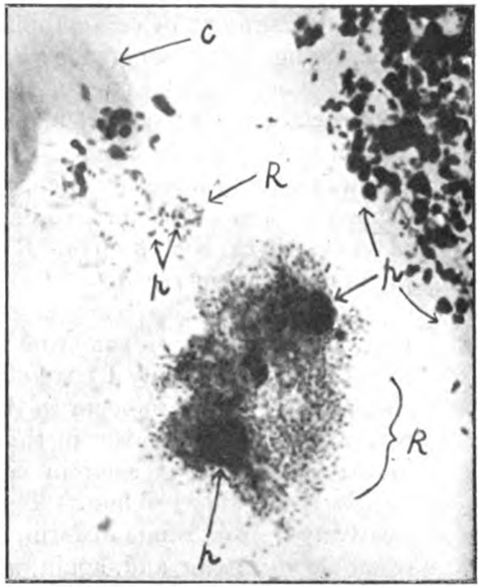

Fig. 21.

Fig. 22.

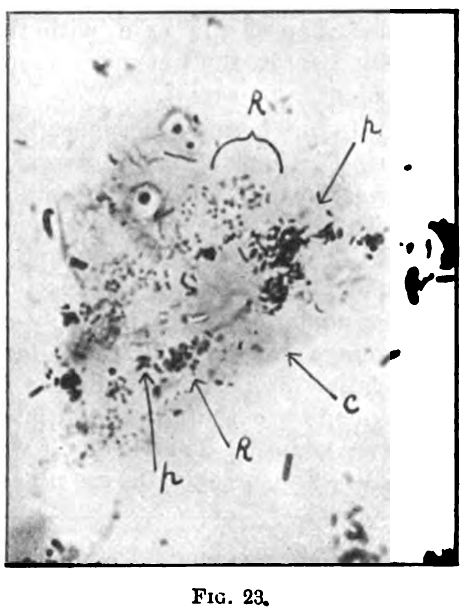

Fig. 23.

dispersed or isolated more or less uniformly in any particular area; and I think this itself is an argument against their being living micro-organisms. Not infrequently, a clump of bodies is in close relation with a pale, blue-staining fragment of cell-cytoplasm, which has been desquamated and is undergoing autolysis (such as is seen at *c*, figs. 21 and 23.) The "Rickettsias" are not actually in this cytoplasm, but lying in contact with, or near to it; part of a cluster may be in contact, the rest separate. Further, very often clumps of "Rickettsias" occur in company with pigment-grains, some of which, at least, are of the same form and size. At other times, in dense clumps, pigmentiferous masses are seen in the midst of them. (In the figures, R = "Rickettsia"-bodies, p = pigment, or pigmentiferous masses.)

The "Rickettsias" are most usually coccoid, or diplococcal in form (figs. 20 to 22), though sometimes cocco-bacillary, or even like slender bacilli (fig. 17). Occasionally I have observed markedly bipolar forms, and also ring-forms; such also occur in the trench-fever type. But there is not the remarkable polymorphism in the case of these normally produced bodies in the louse that is seen in such forms as *prowazeki*, *rocha-limæ*, and *lectularii* of the bed-bug. The great majority of the bodies have a relatively limited range of form, in which respect they much more closely resemble *quintana* and, again, *melophagi* of the sheep-ked, as I observed this latter type. As regards their size, the coccal forms are mostly from 0·4 to 0·6 μ in diameter, while the diplococcal ones average 0·9 μ to 1·0 μ by 0·4 μ. Bacillary forms may be a little longer, up to 1·2 μ in length (fig. 17), though fine, narrow ones, less than 1·0 μ long, also occur. The colour is generally reddish-lilac to lilac, on the whole distinctly more lilac than is the case with the "Rickettsias" in Brumpt's smears; in other words, the tint much more resembles that of *quintana* than of, for instance, *prowazeki*.

In brief, this type, must be regarded, in my opinion, as corresponding to *pediculi* of other observers, which is admittedly very like the trench-fever form. I do not think it can be doubted that we are dealing with an extremely similar type of body in the two cases. Absolutely identical, we should not expect them to be, because one is abnormal, the other is not. And if there is a distinction, I consider it is that the size of the majority of the normally occurring forms is a trifle larger than the average size of the trench-fever forms, because there is not the same relative proportion of minute forms (I say average, because it must be remembered that there is quite a considerable range of size in the trench-fever bodies). This means, I would say, that in the pathological condition, where the breaking-down process of the hæmatogenous material is going

[1] One or two photomicrographs of "Rickettsia"-bodies actually on such fragments were taken, but owing to the blue-stained cytoplasm forming the background, the general result was not good, so that these were among those eliminated.

on wholesale, the ultimate physical disintegration of the residual material tends to be carried to a further extent. And a similar explanation applies to *prowazeki* and *rocha-limæ* (cf. my figs. of the latter).

With the illuminating transitions between the pigment-grains and "Rickettsia"-bodies, illustrated above, to guide me, I have had no difficulty in ascertaining that, in the case of these bodies in normal lice, the great majority of the clusters are produced by a corresponding modification in the pigment. Naturally, in a pathological state (as in the case of *rocha-limæ*), where this production of "Rickettsias" is occurring *en masse* in the gut, it is far easier to obtain such transitional stages in ample number. Nevertheless, in the present case also, clear indications can be obtained when carefully looked for. I have already mentioned that there is frequently an intimate association in occurrence between the two things. And between definite blackish or brownish pigment-grains on the one hand, and equally definite lilac "Rickettsias" on the other, there are usually several granules which one cannot assuredly place in either category—blackish with a tint of purple in, or reddish-lilac, with a tint of brown in, as the case may be; i.e., the same change is taking place, on a miniature scale, of course, that I described above, in the consideration of Brumpt's smears. Such intermediate forms are commonly to be observed in places such as those shown in figs. 21 to 23.

Speaking generally, it is in the case of small clumps of definitely formed and separated pigment-grains that the further alteration occurs. But, occasionally, the "Rickettsia"-bodies are found in connexion with a large, amorphous mass of hæmatogenous material, as shown, for instance, in fig. 20. The greater part of this mass[1] is brownish-green, altered hæmoglobin, in which the pigmentiferous residue is gradually becoming defined, as digestion and absorption goes on. The dark, central part consisted mainly of such pigmentiferous granules. And every possible gradation can be seen in the change in colour of these elements; greenish-black (the earliest stage), almost black, *ditto*, with a tint of purple, deep lilac, and, ultimately, at the periphery (especially at the upper and left-hand sides), typical lilac to reddish-lilac "Rickettsia"-bodies. A very similar position, it may be added, of "Rickettsia"-bodies in relation to dark, hæmatogenous material has been noted in trench-fever smears.

Fig. 17 gives a good example of the transformation of narrow, rod-like pigment-grains into cocco-bacillary or bacillary "Rickettsias." The arrow, *p*, on the right, indicates a clump of closely applied, blackish pigment-rods. The arrows *p*, on the left, point to similar grains, but yellowish-brown in colour, and in the case of one to which the lower arrow points, definitely segmented into a double or diplococcal form. The rest of the little bodies are lilac "Rickettsias." Compare, similarly, the pigment-grains and the

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[1] The right-hand portion has been omitted in the figure, in order to get the "Rickettsias" more sharply focused.

"Rickettsias" in figs. 18 and 19. One or two of the pigment grains here (that, namely, to which the arrow p^1, indicating a little clump, immediately points, in both figures), show an interesting feature, a slight but distinct trace of bipolarity. The two ends are slightly deeper in colour than the central portion. And I have seen "Rickettsia"-bodies manifestly corresponding to these.

Now and again I have found little clumps of "Rickettsia"-bodies, of fairly regular oval arrangement, which I regarded as having resulted from karyolysis. But, from my observations, I should say that the production of definite "Rickettsias" by this particular method is not, for some reason or other, nearly so marked a feature, normally, as it is, for instance, in mites.

General Considerations.

On the other hand, I never observed a corresponding alteration in the pigment in the smears of mites I examined. And I think this difference is an important one and stands in relation with the fact that, in the mite, the pigment-production is *intracellular*, i.e., it is the end product of the intracellular blood-digestion (*vide* my previous paper); whereas, in the louse, all the pigment is produced extracellularly. Another point is that there is a very much greater range of form and size of the pigment-grains in the latter type of digestion than in the former. The inference is, therefore, that the digestion of the hæmatogenous material is performed, somehow, differently by the intracellular ferment in the one case and by that poured out of the cells into the lumen, in the other.

In the mite, the autolysis of desquamated and breaking-down cells has no further influence, apparently, on the endogenously formed pigment-grains, which are simply liberated and dispersed. But I think that when the pigment-grains in the louse happen to come under the influence of the autolytic (?) enzyme of such cells, further alteration *does* occur. And this is my explanation of the mode of origin of the mostly sparse and small clumps of "Rickettsia"-grains in the normal louse. I consider that they result when pigment-grains have been in close contact with such disintegrating cells, some of them, perhaps, temporarily adherent to cell-fragments (*vide* also above, p. 178). Hence their occurrence in any particular louse, at any particular time is largely fortuitous and dependent on whether such autolytic action of broken-down cells happens to have been at work. Probably by careful searching, a few instances could be found in most lice, if the excreta were examined on two or three successive days; though, in the case of young lice, with new, healthy cells, one might not at first find them—until some cells became effete and were desquamated.

I think that the change brought about by this further digestion is manifest, at any rate in one respect, in the separation of the iron from the proteid constituent of the pigment (or from a part of it). These normal "Rickettsia"-bodies, therefore, represent proteid material of pigment-

grains, which have lost their iron. Clumps of "Rickettsias," whose position on the slide had been noted, were de-stained and then submitted to the iron-test, both by the short method (as above) and by the long method, with absolutely negative result. Further, clumps of minute granules, in a fresh unstained smear, closely resembling neighbouring fine granules of yellowish-brown pigment, but which I regarded as "Rickettsias" from the fact that they were colourless, were treated with acidified, dilute methyl-green, and they still remained quite colourless. The smear was then fixed in absolute alcohol and stained with Giemsa, and these colourless clumps proved to be the usual "Rickettsia"-bodies. Lastly, another stained smear, with marked "Rickettsias," was decolorized and then stained with iron-hæmatoxylin. A little smear of blood was also added on the slide to control the differentiation, which was purposely not carried far. The nuclei of the leucocytes were left deeply stained, a large proportion of the corpuscles were still black, and so was most of the hæmatogenous material and pigment. But the "Rickettsias" were either quite unstained or else (in a few cases) very faintly coloured, probably with a trace of bluish Giemsa still left in, and were hardly distinguishable; the result must certainly be regarded as negative. These observations eliminate, of course, the presence of iron or chromatin in these bodies and afford, practically, proof, I consider, that they are not organisms (*vide* also Woodcock [15]). Moreover, my findings entirely agree with the clear demonstration of Nicholson [10] that the "Rickettsias" of Rocky Mountain spotted fever do not stain with iron-hæmatoxylin.

Now, I myself do not think there can be any reasonable doubt that the bodies I have described in this paper from Brumpt's smears and my own, are the same type of thing as the other known louse "Rickettsias" and produced in what is essentially the same manner. It follows, therefore, that, whether we consider *quintana, rocha-limæ* or *prowazeki*, these bodies, in so far as they are produced by abnormal digestion of the hæmatogenous material (i.e., practically entirely in the first-named and very largely in the other two) also represent the residual proteid material after the iron has been removed.[1] Then does this explanation of the nature and mode of origin of these elements imply that those met with in infective lice have no causal relation with the respective diseases? Not at all; on the contrary, indeed, I regard what I have found as constituting still further evidence in favour of my view that these diseases are due to pathogenic enzymes.

I have considered this view fully in my former paper, so that I propose only to add here a few remarks bearing on this new point. I think the biology of the blood-digestion (if I may so put it) is a most important factor in the question. Normally, as we have seen, both in the mite and in

[1] Of course, in the case of karyolysis, they will result from a corresponding degradation of the chromatin, and breakdown of the general nuclear material.

the louse, most of the iron of the ingested hæmoglobin is execreted in the form of pigment. In the louse, the *only iron* which appears to be assimilated is that obtained from the relatively small proportion of the corpuscles which are digested intracellularly.[1] Evidently, the iron of the hæmoglobin taken in as its food is vastly in excess of the normal requirements of the louse.

Next, as regards the pathological change in this blood-digestion, as found, say, in infection with typhus fever or Rocky Mountain spotted fever.[2] In man a noteworthy characteristic is increased hæmatophagy on the part of the vascular endothelial cells. Now, as I have previously shown [14], the specialized macrophages of endothelial cell-type are able normally to exercise hæmetaboly and assimilate the products of digestion in a relatively complete manner, incorporating the iron in their own protoplasm; the only manifest residual product being the platelet granules. On my view, the pathogenic enzyme is one which induces this mode of behaviour on the part of the related endothelial cells of capillaries, etc. It is most likely, I think, that such cells are *not* normally hæmatophagic and platelet-producers to any extent[3] (as are megakaryocytes and large mononuclears, for instance). In the above diseases, however, these cells are stimulated to produce a hæmetabolic enzyme, capable of digesting on similar lines the ingested blood. Nevertheless, the cell condition is somehow different from that of the normal macrophages, because the affected cells also undergo active proliferation. To put the matter in a nutshell, these endothelial cells are *assimilating and using iron to a much greater extent than is customary*. I may add that, although such serious systemic disturbance results, yet I do not consider that the divergence from the normal type of hæmetaboly is anything like so marked in these endothelial cell diseases as it is, for example, in the hæmatophagias of ectodermic epithelial cells such as hydrophobia and smallpox where, from the point of view of the cell, the digestion is entirely unsuccessful, only Negri-bodies, Guarnieri-bodies and so on resulting from the abnormal effort.

If we turn now to the louse we find, I think, that an *entirely comparable*

[1] In the case of the mite, this function appears to be restricted to those particular cells which ingest chiefly the nuclei of the red cells, etc., taken in, and of course no pigment is formed.

[2] The alterations in connexion with the cells of the vascular tissue in trench-fever do not appear to have been yet ascertained.

[3] The reason, I think, that it is extremely doubtful if this occurs normally is just because the production of platelets *would* involve prior hæmatophagy, and this seems most unlikely to take place in the case of the thin and stretched-out endothelial cells, constituting the lining of the smaller vessels and capillaries. Moreover, platelet-production on any scale, implying, as it would, the abstriction of platelet-cytoplasm from large, overgrown cells, would almost certainly lead to blocking and thrombosis; such does *not* occur normally, of course, but, on the other hand, is distinctly in evidence as a result of the abnormal behaviour of the cells in typhus. To suggest the endothelium as an important source of platelets *would* strike me now as utterly unreasonable and illogical; and, indeed, I will confess that, if anyone made such a suggestion I, personally, should be very much inclined to doubt whether he really knew a platelet, let alone its mode of origin!

pathological action is occurring. The cells are producing a pathogenic enzyme which so digests the blood that the iron is not manifestly eliminated in pigment grains. My inference is that this is the same enzyme which is produced by the endothelial cells, and that it is digesting the blood wholesale in such a manner that the iron tends to be separated in some other compound and the excretory residue is in the form of "Rickettsias," the ultimate minute type of which bears a suspiciously close resemblance to a platelet granule. That there is no great difficulty in the way of such an occurrence happening will be understood, I think, if my view that the autolytic ferment produced by these desquamated cells in the course of their own natural breakdown is itself capable of separating the iron from the pigment and leaving "Rickettsia"-bodies is right.

Are the cells of the louse able to *assimilate* this additional iron material? We must bear in mind the wonderfully delicate differences in these blood-digestive enzymes and in the exact mode of the blood-digestion. There is a rich field here for the biochemists to cultivate. Even the normal intracellular digestion of the louse must be in some way different from that of macrophages, because nothing like platelet-granules (or "Rickettsias") are left over in the cytoplasm. And the products of what may be called the platelet-producing cell type of blood-digestion, even if the cells of the louse are capable of assimilating them, may not be (and apparently are not) in the long run so suitable for the welfare of the cells. Again, the normal extracellular digestion is, of course, manifestly different. Now I do not know whether the same type of cell is able to perform both these types of normal digestion. However this may be, I think that both types—intracellular and extracellular—are replaced by the pathological kind in those cases where, in addition to extracellular "Rickettsia"-bodies, we find also intracellular types. And it looks as if an attempt were made by the cells to assimilate and utilize the products of the abnormal intracellular digestion, at least, because of the marked increase in size (hypertrophy) of such cells (cf. especially Wolbach, Todd and Palfrey's figures [13]. Nevertheless, in the end the cell is overcome and we find karyolysis and general breakdown. On the other hand, in trench-fever where intracellular "Rickettsias" are, at all events, extremely rare, and the cells do not appear to be injuriously altered, it would seem that the normal intracellular type of digestion is not affected; and in this case probably the cells do not assimilate the iron-containing product of the abnormal extracellular digestion. This will naturally be of slightly different character (because, on my view, the ferment-virus is different) from that resulting from both types of the digestion in typhus, etc. It is probably much more closely akin to the auto-digestion phenomenon with which is associated the "*pediculi*"-type of "Rickettsias."

Stress has been laid on the fact that a louse does not become itself infective for at least five to eight days after it has fed upon a trench-fever patient, as being important evidence in favour of the view that a micro-organism is the ætiological agent, which has at first to multiply and develop

in the body of the louse. But, equally on my view, a certain time will have to elapse while the pathogenic enzyme is being increased in amount from the minute quantity originally imbibed, adsorbed to the platelets. The more cells that are stimulated to produce this enzyme, the greater of course it will be in amount and the more blood will be abnormally instead of normally digested, with ever-increasing production of "Rickettsia"-bodies. This view affords, equally, an explanation of why "Rickettsias" are not met with at first. And, in the early days, when they are beginning to appear, but as yet in small numbers, the chances against a successful infection are correspondingly high.

It may be thought that I have endeavoured to build up a somewhat elaborate edifice of function upon a foundation of microscopical appearances; still, the above seems to me the most reasonable and logical interpretation not only of my own observations but of those of others I have indicated. And in this connexion I would quote the following passage from a review by Delezenne (*Bull. Inst. Pasteur*, 21, 1923, p. 825) of the great treatise on hæmatology recently published by Jolly: "Que l'étude microscopique des tissus puisse, à l'égal des autres procédés d'investigation utilisés par le physiologiste, servir à interpréter le fonctionnement, nul ne peut en douter. C'est, faut-il rappeler, ce que comprit le premier Claude Bernard, lorsqu'orientant son élève Ranvier vers les recherches microscopiques, il le préparait à poser de façon magistrale les premiers fondements de l'histo-physiologie." I have been led to think there is a tendency among certain physiologists of to-day to treat microscopical anatomy as of negligible utility. I hope I am wrong, because, if they do take that view, they are decidedly to blame!

Lastly, I have only a few words to add about the most recent efforts of certain continental workers to establish a true micro-organism as the cause of typhus (e.g., Barykin and Kritsch [3], Weigl [12]). I confess to a feeling of amazement at Weigl's hypothesis. Apparently, he regards Plotz's bacillus, strains of Weil's *proteus-X*, Barykin's *Microbion* and *R. prowazeki* as all being forms or variants of the specific causal organism. Truly, a hypothesis of desperation! And I gather that Kuczynski also connects the X-strains with *R. prowazeki*. But, if the "Rickettsias" are not living organisms, these views are necessarily dissolved.

Barykin and Kritsch pin their faith to something they call *Microbion typhi exanthematici*, which, it is interesting to note incidentally, they found in *seven per cent of their healthy, control lice!* These authors say that "*Microbion*" cannot be identified with any micro-organism yet found in typhus, with the possible exception of "*R. prowazeki*"—a significant doubt! From the description and figures, I am strongly inclined to think the authors *were* dealing with a form of "Rickettsia."[1] Their principal reason

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[1] Since this was written, I see that, in a review of Barykin and Kritsch's paper by "A. A." (*Trop. Dis. Bull.*, 20, No. 8, August, 1923, p. 661), the reviewer also says: "Indeed, except that it" (*Microbion*) "is amenable to cultivation, it agrees in all particulars with that Rickettsia" (i.e., "*R. prowazeki*").

for regarding "*Microbion*" as a micro-organism is because they were able to cultivate it in a special "Organbrei," consisting chiefly of splenic, or brain-tissue. Oh! these tissue-media, I do think they are responsible for a lot of erroneous conclusions! I have myself little doubt that the pathogenic enzyme was causing breakdown of the hæmoglobin and cell-lysis, with the usual end-result of bacteriomorphic granules, of one kind or another (cf., my reference to Kuczynski's "cultivation" of *R. prowazeki* in my previous paper, p. 259). I will merely quote here from M'Leod and Bevan-Brown (*Journ. Pathology*, 22, 1918, p. 79): "It is perhaps worth while mentioning here that, in the course of the careful examination of these cultures" [which were blood-cultures from trench-fever !] "a phenomenon was observed which, so far as we have noticed, has not received much attention. We draw attention to it because it serves to emphasize the caution necessary in accepting as evidence of bacterial growth various forms which appear in culture-media that contain animal tissues undergoing autolysis. The phenomenon consists in the appearance of granules in the red corpuscles which take a deep stain with fuchsin or with stains appropriate for moulds." The authors thought they were dealing with bodies simulating moulds, but their figures suggest irresistibly to my mind stages in the (artificial) production of "Rickettsia"-like bodies from the blood undergoing lysis or digestion by the pathogenic enzyme. And I think the same explanation will apply to the "*Microbion*" appearing in Barykin and Kritsch's "cultures."

The evidence that the "Rickettsias" represent, or indicate the virus of trench-fever and typhus-fever is, to my mind, strong—very strong indeed in the case of trench-fever. And if this is true for the one, there can be little doubt it is true also for the other disease. The valuable experimental work which Arkwright and the late A. Bacot were able to carry out in Cairo [1] points unmistakeably in this direction. Even Weigl (*l.c.*) wrote: "Auf Grund der Ergebnisse der Rickettsienforschung müssen wir die *Rickettsia prowazeki* als die Form des Fleckfiebererregers in der Laus ansehen. Diese wohlbegründete Annahme scheint endlich durchgedrungen zu sein." Now, the pathogenic "Rickettsias" are certainly, I think, solely products of abnormal hæmetaboly and karyolysis of the diseased cells. Does not this almost inevitably imply, therefore, that *the actual virus is an abnormal hæmetabolic enzyme?*

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[16] *Idem.* "'Rickettsia'-Bodies as a result of Cell-digestion or Lysis," *op. cit.*, xl, 1923, 81, 241.

EXPLANATION OF FIGURES.

FIGS. 17 to 23.—"Rickettsia"-bodies from the excreta of normal lice.

FIGS. 17 to 19, and 23.—Illustrating transitions between pigment-grains and "Rickettsia"-bodies. *R*, "Rickettsia"-bodies; *p*, pigmentiferous masses and grains; p_1, figs. 18 and 19, pigment-grain with distinct indication of bipolarity, the two ends being more deeply coloured; *c*, fig. 23, fragment of desquamated cell-cytoplasm.

FIGS. 20 to 22.—Coccal and diplococcal forms of "Rickettsia"-body and their relation to the pigment. (Lettering as above.)

A BRIEF REVIEW OF THE PROGRESS OF MILITARY HYGIENE SINCE THE WAR.[1]

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I hope that during this Session we shall have before us many interesting papers for discussion, and we should, I think, bear in mind that one of the objects of the group is to exchange freely our views on matters affecting the welfare of the fighting services, and that in peace we should prepare for war by endeavouring to obtain a clear conception of the best and most approved methods of sanitation and should apply all new scientific data to the requirements of active service in the field. The marvellous progress in the theoretical knowledge of hygiene was to a great extent in the late war followed by a manifold practical application in every branch of the science, and it is well known how through this advance we surpassed all earlier effort; but even so there always remains the feeling that possibly more might have been done in spite of all our efforts. The prevention of disease means looking ahead, and our aim should be to anticipate the many problems which arose during the past war and think out the new ones which will appear on active service in the field under the advancing conditions of warfare.

It is clearly then our duty to try and visualize future operations and be prepared to reduce our shortcomings to a minimum, and this, I feel sure, can be materially assisted by the deliberations of our group so happily constituted.

The methods which we adopt in attaining the solution of our problems will be based on our scientific work and the experience gained in the late war will still form a sound basis for future action, just as the limited experience gained in the South African War served us in such good stead during the last war and gave rise to the foundation on which our sanitary organization was built.

In the "Medical History of the War" we have now at our disposal a more or less complete summary of the measures of prevention undertaken in all theatres of the war. This work undoubtedly will be of the greatest assistance in helping us to formulate our plan of campaign in the future. For this most valuable help we are indebted to our late president, who as editor-in-chief of the "Medical History of the War" has spared no pains to produce a record of which he may be justly proud.

In addition to extending our own outlook we must ensure also the education of the whole personnel of the Services in all matters concerning

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[1] Presidential Address read at the opening meeting of the new Session of the Army, Navy, and Air Force Group of the Society of Medical Officers of Health, November 30, 1923.

hygiene and sanitation in so far as it affects life in the field. This education of the sailor or soldier must be thorough—more in harmony with modern scientific progress and such that ritual becomes a matter of daily routine. The subject has specially occupied our attention since the war, and all officers and men are receiving instruction in hygiene at the Army School of Hygiene at Aldershot. An attempt is made to produce a hygienic conscience and to a certain extent faith must take precedence over knowledge.

Although naval or military hygiene may necessarily differ to some extent from that under civil conditions, especially in its application in the field, yet in principle it in no way differs from general hygiene, and hence the value of our group is not limited to the fighting services alone. Army hygiene is often of special value to the Civil Public Health Service, since ideal experimental conditions are facilitated in service practice and in field sanitation, and certain problems can be studied more freely and to a greater extent, perhaps, than would be practicable under civil conditions. Again, in the Service, continual observation of the sailor or soldier and his family, widens our views on epidemic problems. Measures directed against outbreaks of infectious diseases are also facilitated in the circumstances attending life in the Service, and the control of environment can be more thorough and systematic than is often the case in civil life. Such measures as isolation, the daily examination of contacts, increased spacing out in sleeping quarters, disinfection of messing utensils, and preventive inoculation, are examples of measures which should present little difficulty in our Services.

It is generally recognized that the exercise of Army discipline does much to facilitate the application of hygiene measures, and in consequence, the health conditions of a unit are directly proportional to its discipline. The best disciplined regiments for example show the lowest sick rate.

In the Services, the chief function of the hygiene authorities is to advise on all measures of health affecting the troops, but it is only by the interest and co-operation of regimental officers, especially company officers, that the best results in the prevention of disease can be obtained. The value of hygiene in the prevention of wastage of man power, not only in peace, but more especially in the field, is recognized by all branches of the Army and the interest taken and the assistance given, by the General Staff and other branches, not only make the task of the medical authorities easier, but tend to infuse the right spirit of hygienic discipline and precept throughout the Services.

On many occasions during the war, medical officers of foreign armies commented on the fact that in the British Army hygiene measures were greatly facilitated, not only by the interest and assistance afforded by all combatant officers, but also by the training in hygiene and sanitation, which officers and men had received prior to the war and continued to receive even during the stress of the intensive training of the new armies.

The knowledge gained in the Services by observation carried out in all parts of the world, is naturally of great interest to the civil hygienist, and indeed, co-operation between the civil, naval and military services has been the means of elucidating many an obscure problem, resulting in a general benefit to the nation. It is only by such mutual confidence and co-operation that any real progress can be made, and it is obviously to the advantage of both civil and military preventive services to foster this in every way.

It is also essential to success that, in addition to a close co-operation among all the Regular Services, the Auxiliary Services should as far as possible keep themselves in close touch with all hygiene movements and measures of control which are carried out in the Regular Army both at home and abroad.

It is likewise an advantage to keep ourselves informed of all recent advances in military hygiene made by foreign powers. The official publications of the American and French military medical departments are particularly interesting and instructive.

Time is bringing the fulfilment of many a recommendation made by medical officers and others in the past, and doubtless many of the improvements we so earnestly desire will be eventually made, even though we may not live to see them.

All measures for the improvement of health or the prevention of disease are more or less costly, and no financial branch of the public services can view a hygienic innovation dispassionately, unless it is shown that ultimately a gain in economy will be effected by improvement in general health. It is the duty, however, of the medical authorities to bring to notice any measure which they believe, after due consideration in all its aspects, to be necessary to preserve or improve the health of the troops, even though the recommendation cannot be carried out at the time, because of financial or other difficulty.

The record of the recommendation should always be at hand, to be returned to again and again until fulfilled, and very often a part of the recommendation, or some modification of it, which will eventually bring about the completion of the whole, may be carried into effect.

Since our group consists of members, all interested in the public health aspect of the fighting Services, to many of whom we shall look for help and advice when occasion arises, possibly it will be advantageous to remind you of certain problems that have arisen since the war, and to inform you of the progress which has been made for the betterment of the soldier in regard to his personal welfare and efficiency. Although much has been done and is being done, still many problems remain, some of which for reasons of economy are held over at present, but eventually they must be solved. In this respect, bearing in mind that a very large amount of disease can now be attributed to overcrowding, I feel that the problem of increased space per head in barrack rooms, combined with better lighting

and ventilation, can still profitably occupy our minds in the future, and that we have by no means solved the difficulty of preventing overcrowding on active service, or the all-important problem of ensuring cleanliness and freedom from vermin in the field.

Public health, as applied to the civil community, is concerned with the individual during the whole period of life, but in the fighting Services it is chiefly concerned, for all practical purposes, with selected personnel during a certain period of life. Practically, and as it should be, it is the best and most active period (from 18 to 40 years of age) with which we are chiefly concerned.

In this short address it will only be possible to mention some of the progress which has been made since the war under two headings:—

(1) Recruiting and enlistment.

(2) Service at home and abroad.

(1) Recruiting and Enlistment.

Recently the whole of the duties connected with the medical aspect of recruiting have been taken over by the Directorate of Hygiene. By this administrative change, the Directorate of Hygiene is not only responsible for the preservation of the soldier's health, but also from a health point of view, for his selection and training as a recruit.

It is not necessary for me to dilate upon the importance of this new burden of responsibility which has been added to a scientific branch of the Army Medical Service; it should suffice when I tell you that so long ago as the middle of the seventeenth century both the Prussian and the Austrian Army Regulations emphasized the fact that "The duty of inspecting recruits and defining whether they are fit or unfit for military service is the most difficult and responsible that an army surgeon has to perform."

At the present time, the man power of the country is suffering from the effects of a long continued war, much in the same manner as did the French after the general peace in 1826. In that year out of 1,033,442 soldiers drafted to serve in the Army, 380,213 were sent back because they fell short even of the diminutive stature of sixty-one inches.

Our difficulties at the present time are not connected so much with the stature, but with the general physique and minor disabilities from which so many of the recruits are suffering when they present themselves for enlistment. In this connexion, I would draw your attention to the fact that the percentage of medical rejections on enlistment increased roughly from twenty per cent in 1912-13 to thirty-five per cent in 1920-21, and the present day rate of rejection is even higher.

The medical branch is not concerned, except in an advisory capacity, with fixing the limitations of age and height for a recruit; these are, and always have been, governed by the supply of and demand for recruits. It is important to remember, however, that whilst the youth of from 18 to

20 is more easily moulded to the requirements of a trained soldier, a youth never becomes really efficient as a fighting man until after the age of 20 or 21. The memorable remonstrance of the Emperor Napoleon to the legislature of France should not be forgotten. "Shame on you!" he wrote. "I demand a levy of 300,000 *men*; but I must have *grown* men. *Boys* serve only to fill the hospitals and encumber the road-sides." The vast number of immature conscripts who gave out on long marches during the campaigns of the French Emperor, and particularly during the march to Moscow, is well known.

In dealing with the subject of recruiting, it is interesting to consider the statistics relating to the disabilities for which recruits are rejected. The most common cause for rejection in previous days was "Diseases of the Heart" and whilst the percentage of rejection from this cause has not increased to any great extent there has been a marked increase in the percentage of rejections for disabilities which may be attributed to, or be connected with faulty nutrition and development, possibly the result of the war. I refer to defective vision, defective and deficiency of teeth, under-chest measurement, and flat feet.

The increased strain on the nervous system consequent on the "frightfulness" of modern warfare has led to a greater amount of attention being focused on the mental capacity and nervous stability of the recruit on enlistment, as a possible means of lessening the incidence of shell-shock and allied war neuroses. To this end, investigations are at present being conducted to try and establish a standard of mental capacity for the recruit on enlistment and at the same time a War Office Committee is dealing with the subject of Disordered Action of the Heart. It is hoped that by the provision of a standard of normality as regards the tolerance of the heart to exercise, to lessen the discharge of recruits under this head. Researches are being continued, so as to arrive at more definite standards of physical normality, more especially with regard to the normal ratio of weight to stature, and the relation of body weight to the economic load which the soldier can carry.

I will not burden you with a mass of figures dealing with the statistical results of recruiting, but the brief reference I have made to what is being done may give you an idea of some of the problems connected with the medical aspect of recruiting.

Depot Training.

A recruit who is passed medically fit at a recruiting depot and after final approval by the approval officer, joins his regimental depot for what is perhaps the most important phase in his career as a soldier. At this depot he receives a further medical examination to ensure that no disabilities have been missed at his primary medical examination which are likely to interfere with his future efficiency as a soldier. He remains at the regimental depot for approximately five months, during which period

he is under constant medical supervision by the medical officers in charge of effective troops, and at the same time is periodically inspected by the Assistant Director or Deputy Assistant Director of Hygiene, who is able to scrutinize very closely his hygienic surroundings, his food, clothing, physical training, and in fact all details which combined make an ideal system for producing a trained soldier from the raw recruit in the shortest period possible. Particular attention is paid to the systematic weighing of the recruits whilst at their training, and any recruit who loses or fails to gain weight whilst at the depot is very carefully medically examined for the cause. It is interesting to note that the generally accepted idea that a normal recruit loses weight during the first fortnight of his training has been exploded. It has been proved recently that the normal recruit steadily gains weight during his twenty weeks period at the depot; the average increase being in the neighbourhood of ten pounds. Admissions to hospital are followed invariably by a drop in weight commensurate with the degree of sickness, and curiously enough, absence without leave, involving in all probability excesses of one nature or another, generally is followed by a drop in body weight. Furthermore, investigations are proceeding in conjunction with the physical training branch, the result of which it is hoped will facilitate the elimination of the nervous unstable recruit from the ranks of the trained soldier. In this connexion I would emphasize the importance of endeavouring to train the recruit in the "unknown quantity" of modern warfare.

The period spent at the depot is all too short, but at present it has to be controlled by the demand for overseas drafts, and as a contrast, I would draw your attention to the lengthy period of probation which recruits for the Roman army had to undergo before they were finally approved.

This period according to Vegetius was of four months duration, and even then the recruit did not receive the military rank of a soldier until he had satisfactorily proved that he had the necessary physical ability, mental capacity and courage to endure the hardships and dangers of a soldier's life.

(2) Service at Home and Abroad.

In the first place let us consider what part the Directorate of Hygiene plays in the service of the soldier during his whole career in the Army.

The Directorate is concerned with all matters relating to the preservation of health and the prevention of disease. Collection of information as to the prevailing diseases, water supplies, geology and meteorology of possible theatres of war, and formulation of preventive measures and suggestions as to suitable clothing, dietaries, etc. Medical questions and statistics in connexion with recruiting. Medical and sanitary questions in connexion with barracks, hutments, hospital ships, water supplies, and methods of purification; schemes for the disposal of waste water, refuse, and excreta. Technical questions as to disinfectors and disinfectants; food requirements of the soldier; clothing and equipment. Consideration of

inventions dealing with the prevention of disease and advice on the supply of materials. Organization and direction of research on matters affecting the health of the Army. Liaison with public health departments at home and in foreign countries.

It also maintains a close co-operation with the Directorate of Pathology, since the prevention of disease is from a scientific point of view intimately dependent on mutual investigation in pathology and hygiene.

In regard to all questions affecting accommodation in barracks and camps, we should recall the wonderful and valuable recommendations made by the Royal Commission appointed in 1857 to inquire into the Regulations affecting the Sanitary Conditions of the Army. This report, in spite of the lapse of time, still repays a close study and should be read by all interested in the subject. Personally I find a reference to it of the greatest value, and for sound common-sense principles as applied to barracks and general sanitation it cannot be surpassed.

The outcome of the recommendations made and carried out was to reduce the death-rate from 17·5 per 1,000 in 1857, which was then double that of the civil death-rate, to 3·4 in 1897, and to 2·2 at the present day. In 1862 the Commission was constituted a standing body and had its counterpart in the Army Sanitary Committee, appointed after the Crimean War, and by the Army Hospitals Committee which was formed in 1903. These two Committees were amalgamated in 1906 as an Army Hospital and Sanitary Committee and it was this Committee which was absorbed in the Army Medical Advisory Board in 1907. To this Board was attached an expert in sanitation and an expert in tropical diseases.

The Board decided that two sub-committees should be appointed to carry out investigations of various matters connected with the work of the Board, more especially as regards the prevention of disease. These sub-committees were termed Pathological Sub-Committee and the Hygiene Sub-Committee.

The Board also appointed the following sub-committees: Sanitation, Construction of Barracks and Hospitals, and Equipment (including Clothing and Ambulance Transport).

On the outbreak of war in 1914, the Army Sanitary Committee was reconstituted in November of that year to advise on all matters connected with the health of the Army at home and overseas. It consisted of representatives of the Local Government Board, India Office, and the civil and military sanitary experts of the Army Medical Advisory Board.

The present Army Hygiene Advisory Committee was formed in 1919 as part of the Directorate of Hygiene, and replaces all former hygiene committees. In addition to military members representing the General Staff, Quartermaster-General, Master-General of Ordnance, and Director-General, Army Medical Service, Civil Public Health is represented on the Committee by three distinguished members.

The duties of this Committee embrace the following:—

Sanitary problems in connexion with barracks, hutments, hospitals, water supplies and methods of purification; schemes for the disposal of waste water, refuse and excreta.

Technical questions as to disinfectors and disinfectants, food requirements of the soldier, clothing and equipment.

Organization and direction of research on matters affecting the health of the Army. Consideration of Parts I and II Hospital Services.

The function of the committee is in some respects similar to that of the Royal Commission of 1862 as it advises on all sites for new barracks or hospitals and type plans, especially in regard to sanitary requirements.

Hygiene Organization in War.

When an army takes the field in future there will be a complete hygiene organization based on the experience gained in the late war.

In forces of small size, assistant directors of hygiene and pathology will be appointed to the headquarters of the force, and as many deputy assistant directors of hygiene and pathology as are considered necessary.

A representative of the Directorate will also be appointed to the headquarters of a corps. Sanitary sections will be allotted to armies in the field in the proportion of one to each division and commanded by an R.A.M.C. officer specially trained in sanitation, but not necessarily a medical officer. Each section will have a fixed establishment of trained N.C.O.s and men including tradesmen, such as bricklayers, carpenters, and sign painters. The N.C.O.s are now termed serjeant or corporal sanitary inspectors.

For a force of one or more armies, a directorate of hygiene, similar to the peace establishment, will be required.

In addition to the above organization the hygiene directorate of an army in the field will be supplemented by mobile hygiene and bacteriological laboratories, and base hygiene laboratories. It is interesting to note that the first appearance of a laboratory in the field was in the South African War.

It is satisfactory to record that the health of the Army since the War has steadily improved and that at the present time the health statistics are only a little above pre-war figures. In this connexion, however, we must remember that we have not yet returned to full peace conditions and that until quite lately troops were still occupying several unhealthy areas in new territory acquired during the War.

The incidence of venereal disease and scabies in the Army at home has steadily declined since the war and this is due entirely to the hygienic preventive measures adopted in all commands.

The incidence of venereal disease in 1920 was 48·3 per 1,000 of strength and that of scabies 51·57.

At the present time the ratio per 1,000 for venereal disease is 25 and for scabies 8, and in each case is lower than that shown in pre-war returns.

The general mortality rate is now reduced to pre-war figures and there appears to be no reason why it should not further be reduced.

It is an interesting fact that minor injuries head the list of prevailing diseases in commands at home, followed by venereal disease, disease of the digestive system, inflammation of the bowels, and areolar tissues in that order. Venereal diseases, diseases of the digestive system and injuries, head the list for service at home and abroad.

Formerly, in all armies, even in peace, the mortality due to injuries and accidents was greater than in civil life. The mean of the four years 1859 to 1862 was sixty-one per 1,000. The mortality due to injuries in 1922 was 0·68, a little lower than in 1913.

In the years 1859 to 1862, it is interesting to note that the diseases in their order of fatality were tuberculosis, violent deaths, pneumonía, diseases of the heart, fevers (typhoid and typhus), diseases of the nervous system, bronchitis and delirium tremens.

The mortality from tuberculosis at that time for the whole Army was not in excess of the rate for the civil population, the rates being 3·8 and 3·5 respectively per 1,000 living. The incidence fell most heavily on the Foot Guards, however, and was computed to be nearly four times as much as among the civil population of from 25 to 45 years of age.

The great sanitary reforms of Lord Herbert and the Royal Sanitary Commission which were carried out in 1858, shortly after the Crimean War, led to an extraordinary decrease in the mortality of all arms, and especially in respect of tuberculosis.

The Royal Commission reported that 57·3 per cent of the deaths in the infantry of the line were caused by diseases of the respiratory organs, and of the deaths in the Guards no less than 67·6 per cent. The total rate of mortality per 1,000 per annum amounted to 17·6, which was nearly double that of the civil male population of army ages. They considered that the cause of these high rates of mortality could be assigned to :—

(1) Night duty.

(2) Want of exercise and suitable employment.

(3) Intemperance and debauched habits among soldiers.

(4) Crowding and insufficient ventilation, and nuisances arising from latrines, and defective sewerage in barracks.

At the present time the admission rate for tuberculosis in the Army is 1·3, whereas up to 1862 it was somewhere about 3·6 per 1,000.

In regard to disabilities classified under disease of the heart which still are a frequent cause not only of rejectment on enlistment but also of admission to hospital and invaliding, there is no doubt that much of the high incidence in the past was due, as pointed out by Dr. Maclean, then Professor of Military Medicine, to the mischievous restriction to which the chests of the soldiers were subjected at a time when the maximum of exertion was demanded. In 1866 at least fourteen per cent of discharges were due to heart disease.

Delirium tremens which in those days accounted for a mortality of one per cent has now practically disappeared from army medical returns. Probably never in its history has the Army been so temperate as it is at the present time, and to this alone can be attributed much of the improvement in health and physique which exists to-day.

I am not concerned at present to enlarge on this subject, but the question originally put by Edmund Parkes as to whether there are any circumstances in the life of the soldier in which the issue of spirits is advisable deserves some consideration. It does not appear to be generally known that alcohol forms no part of the soldier's ration either in peace or war, nor to my mind is it really necessary except under exceptional circumstances, and then only on the advice of a medical officer. We all know that in the late war a ration of rum on occasions was beneficial in the exceptional circumstances of life in the trenches, when men were exposed day and night to inclement weather, fatigued beyond measure and exposed to constant and unremitting mental strain. Until we find a suitable substitute, a certain amount of alcohol in the shape of spirits seems to me to be beneficial as a nerve or gastric stimulant to men under circumstances such as these, but habitual use is not justified under any conditions of service.

Special Research.

Within the last few years there is one direction in which hygiene has made marked progress, and that is in what may be termed physiological and bio-chemical hygiene. From the study of this branch of hygiene, more and more, do we see what possibilities are opened up to us, and the bearing it has on the improvement in the life and welfare of men in the Service. The Army Hygiene Advisory Committee has paid great attention to the work of a soldier and has already issued several reports, which are of great practical value. Especially would I mention the work in 1917 of Professor Cathcart and Captain Orr, on the energy expenditure of the infantry recruit in training, undertaken to determine the food requirements for the performance of military duties. Beyond the two researches conducted in 1913 under the direction of Colonel Melville on the energy requirements of marching there had, up to this time, been no serious investigation of the food data, and the work of Professor Cathcart and Captain Orr fulfilled a much felt want. The result of their investigation has been to facilitate the construction of army diets under all conditions of military training and service.

The recent physiological observations and experience of Professor Cathcart and his co-workers, making use of the perfect methods of research of modern science, have successfully demonstrated that the economic load of the soldier should not exceed one-third of his body weight. This may be regarded not only as a close approximation to the truth but possibly will not be changed by further or better grounded work. It is true that

the economic load of the soldier has been recognized as a third of the body weight for many years, but it is due to Professor Cathcart that the limit of the economic load has now been decided by practical scientific observation, never achieved or attempted before. The practical outcome of this is, that the average soldier weighing 135 pounds should not be expected to carry more than forty-five pounds properly distributed, if his maximum fighting efficiency is to be assured. Although it is not expected that this standard can at present be attained, because modern warfare necessitates so much to be carried for protection alone, still it serves as an ideal standard around which to work and already the weight now carried is very greatly diminished from that which gradually accumulated in the past war. I would refer those of you who desire further particulars, to the Report No. 3 of the Army Hygiene Advisory Committee, published in the June, July and August Nos., 1923, of the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS.

Let me also mention the investigations of Captain A. G. Stevenson, of the R.A.M.C. and Captain R. L. Brown, Royal Engineers, on the motion study of digging and the energy expenditure involved. From a military, as well as a civil, point of view this question is of considerable importance and with the exception of one or two researches in shovelling by American workers, no serious investigation of digging had been undertaken with the object of increasing efficiency of output and economizing energy. During the late war skill in digging was thought to be of a poor type and was lacking in uniformity: accordingly, a digging drill, based on common-sense principles with due regard to the methods of skilled navvies, was introduced as part of the training of recruits in the Royal Engineers. It was thought that a complete scientific investigation of the whole problem, therefore, would still further increase efficiency in digging and as a result of this piece of research a new drill resting on a sound scientific basis is being introduced for both the Royal Engineers and the Infantry.

Mention should also be made of the series of analyses of the commoner foodstuffs by Professor Plimmer carried out during the war and completed under the Directorate of Hygiene and published in 1921.

During the late war, especially in the Army, an authoritative series of analyses was greatly required, since much of the data already in existence referred to food in other countries than our own.

Owing to the lack of a common standard, there was no uniformity in the energy value of rations constructed in the different theatres of war and the need of a standard series of the foodstuffs of our country was much felt. This most important and most valuable piece of work now forms the basis of a common standard of food values for all branches of His Majesty's Services.

Some interesting work has been carried out during the past year with a view to the determination of the food requirements of growing boys.

In order to obtain some standards for comparison, it was considered

that more information was necessary as to the growth and physical development of boys in military schools and boys in the general population, and the first results obtained made it clear that age alone could not be used as a basis. It could not, for instance, be assumed that taking seventy-five pounds as the average for a boy of 12 years, a boy of the same age weighing only seventy pounds was of inferior physique.

It became necessary, therefore, to establish the relationship between weight and stature, with a view to the utilization of the latter in lieu of age as the basis.

Here, there are variations between races and individuals, but Professor Dreyer in his book, "The Assessment of Physical Fitness," gives tables showing that a definite relation exists between trunk height and other desired data, irrespective of age.

Weight, again, has variations, which occur in a normal and healthy person as a result of the virtual impossibility of balancing input and output. A weekly variation of from three to four pounds is quite compatible with health, and seasonal variations are also recognized. There is also the physiological increase in weight which takes place after the age of 21. Notwithstanding these difficulties, it has been possible to construct a hypothetical table showing a definite and progressive increase in weight for each inch in height up to 21 years, and, on checking this table by reference to actual heights and weights of large numbers of recruits, the results were found to bear a close resemblance.

A further hypothetical table of calorie requirements for the average youth expending average energy was constructed by Lieutenant-Colonel Sylvester-Bradley on the basis of the formula $(H - 3)^2 = C$, when H = stature in inches, and C = total food requirements in large Calories.

From comparison with actual dietary tables as regards known units, the table appears to work out correctly. A diet of this value enables the boy of four feet in height to receive the 2,000 odd calories he requires, and the boy of five feet three inches 3,600; and, given the average height of the boys in an institution, the calorie requirements, and hence the dietary of any given number of boys can be worked out.

Tonsillitis.

Tonsillitis has always been prevalent in the Army, and shows an annual ratio of thirty-three per 1,000 at the present time. Up to now sufficient attention has not been paid to a disorder which, although generally mild in type, yet constitutes a distinct cause of inefficiency. It, undoubtedly, is a disease respiratory in transmission, and associated with overcrowding and neglect of efficient ventilation. This is borne out by the fact that troops in camps and under canvas even in winter rarely suffer from the disease, except under the conditions of overcrowding. During the winter of 1914-15 hutted accommodation was inadequate in many camps in this country and overcrowding became excessive. It is not surprising, there-

fore, that outbreaks of tonsillitis were very frequent and the type so severe that the disease was often prefixed with the name of the camp in which it originated, e.g., "Bulford sore throat." The disease is frequently met with in barracks in hot dry countries during the spring months, and is attributed by some military medical officers to dust. It is also of interest to note that the incidence of tonsillitis is far greater among troops in Egypt, Palestine, and India, than at home.

During the war in France tonsillitis was infrequent and certainly the incidence was low among men in the line. The disease appears to be more prevalent in old barracks, where overcrowding is apt to occur, and there has been a marked incidence among troops on board transports. Prior to the improvements in the accommodation on transports which have recently been sanctioned, the incidence of tonsillitis on board ship was 68·8 per 1,000, exactly double that in barracks at home and in foreign stations. In this connexion there appears to be some relationship between tonsillitis and minor septic diseases, both of which account for a relatively large number of admissions to hospital at home and abroad and on board ship, and the only remedy at present would appear to be greater attention to the allowance of space per man in barracks, aiming at a clear space of three feet or more between adjacent beds.

It is generally conceded that the spread of infectious disease affecting the respiratory tract is influenced in army life by a variety of circumstances of which overcrowding is probably one of the most important.

All epidemiological experience points to the very marked effect which overcrowding exerts upon the spread of disease. It is a matter of common knowledge that where diphtheria occurs among men who are crowded together, carriers of the Klebs-Löffler bacillus are unusually numerous and when these men are spread out in well-ventilated quarters the "carrier" condition rapidly disappears. The evil effects of crowding together in ill-ventilating wards patients suffering from measles or influenza are well-known. The severity of the disease increases, and deaths from pneumonia as a complication may reach a high figure. One recalls the high rate of mortality from pneumonia, which occurred in 1918 on the overcrowded transports carrying American troops. All experimental evidence supports the view that the distance between beds is of paramount importance, and that quite a moderate degree of spacing out of beds combined with simple methods for improving ventilation is highly effective in reducing carrier rates.

Proximity of heads and degree of ventilation are therefore the criteria by which the adequacy of accommodation in barracks, quarters and on board ship, should be judged. During the war and since, I have always emphasized the importance of considering wall space as a guide in the prevention of overcrowding.

In one of the commands, an attempt has been made to space out the beds in barracks so that the heads of the occupants are separated by an

interval of six feet, where the number to be accommodated, the shape of the room and the position of the windows admit. The officer commanding the unit notifies the officer in medical charge when closer spacing has to be adopted, so that a close watch for evil effects arising from this cause can be kept.

In regard to tonsillitis; the pathological directorate in association with the hygiene directorate have instituted investigations to determine the bacteriological flora of tonsillitis, and the bacteriological flora of the throats of contacts in barrack rooms from which cases of sore throat are constantly reported, to ascertain prevalence of carriers, and it is hoped some practical solution in the way of prevention may result.

Sandfly Fever.

During the war sandfly fever was very prevalent in Egypt, Palestine, Macedonia and Mesopotamia, and caused much sickness among the French troops at Cape Hellas. In badly infected areas it was possible for fifty per cent of the troops to develop the fever within a few weeks under field conditions.

Since the war the disease has caused some anxiety, not only in Mesopotamia, Egypt and Palestine, but also in India, Constantinople and Malta, and recently in Jersey, and a great deal of scientific investigation is being carried out as to the best means of prevention under all conditions of the soldiers' service.

The most recent work on the subject has been contributed by the Royal Air Force Sandfly Fever Commission, in Malta, who issued their report in February, 1923, on the prophylactic measures directed against phlebotomus. The measures suggested are divided into general, to be carried out by the unit as a whole, and personal, to be carried out by the individual. Among general measures are advised the levelling and drainage of the ground, filling in of cracks and holes in walls, repair of windows and doors, ventilators and rainwater gutters. Facing, painting and tarring walls and the regular limewashing and painting of interiors. They recommend, also, spraying huts and other buildings every week with a one per cent solution of cresol. Among personal measures, bathing after dusk, the wearing of slacks after sunset, and soiling of the ground must be prohibited. The use of sandfly nets and repellents, such as camphor in beds. with the utilization of natural air currents and a liberal supply of electric fans, are considered essential.

In the Near East we found it necessary to issue sandfly nets for the use of all troops, but have not placed any reliance on repellents. The mention of mosquito nets brings us to a most important consideration, and one in which we have now come to a definite conclusion, namely, the standardization of mosquito netting for protection against mosquitoes and sandflies.

A great deal of confusion existed in regard to the factors necessary to

determine the mesh and the method to be employed in its calculation. Measurements were based on so many holes to the linear inch, but it was not clear to anyone what this really meant or whether the measurement was to be taken along the warp or along the bobbin. These measurements also did not correspond with those used in the trade, and much confusion resulted. The measurements formerly recommended were as follows: A mesh of 12 holes to the linear inch against ordinary mosquitoes, of 16 to 18 against anopheles or stegomyia, and of 22 against sandflies.

Colonel MacArthur took the question up in January, 1923, and the result of his work has smoothed out our difficulties and placed the standardization of mesh for army use on a clear basis. His article on the subject appears in the January, 1923, number of the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS. Measurements are now taken in two directions, horizontally along the warp and obliquely down the bobbin, the corner hole being counted twice; the thickness of the thread being taken also into consideration.

Colonel MacArthur considers that cotton netting of 25/26 holes to the square inch and woven 30/s or 40/60 cotton will exclude mosquitoes when used as a mosquito curtain under natural conditions. A finer mesh, however, is desirable for veils.

The standards now recommended for army use are the following:—

	Count.
Mosquito netting	28/29 hole.
Mosquito veil netting	40 „
Sandfly netting	48 „

Rations.

Very shortly after the termination of the war, it became necessary to revise the rations of the soldier both for home and abroad, and also the scale of diets for patients in military hospitals. Naturally during the war the scale of rations had considerably increased above that required in peace and the return to a fixed peace scale was not only in the interest of the soldier but made for considerable saving in public expenditure. Prior to the war, the soldier received ¾ pound of meat and one pound of bread supplied as a free ration and in addition a money allowance of 3d. per head was given to supplement the ration issued by the Government. Dr. Pembry calculated that this ration gave an energy value of 3,369 calories, while if the amount purchased by the soldier out of his own pocket was included each man might receive 4,000 calories per day.

A very great improvement of this ration has been made since the war and the soldier to-day receives an ample ration at Government expense. From a scientific point of view this is most desirable, since a standard ration makes it possible to study the relationship to energy expended during training and otherwise. The new rations both for home and abroad were carefully considered by the Army Hygiene Advisory Committee and a standard fixed, below which it would be unsafe to go.

Efficiency and economy had both to be considered and the ration as it stands to-day has proved to be entirely satisfactory.

The daily energy expenditure of the soldier at the present time amounts to somewhere about 3,380 calories and the ration for home service was based on this daily expenditure of energy. Other factors had also to be taken into consideration, such as food for growth, etc., so the energy value of the present ration is equivalent to 3,600 calories per diem; also it must be remembered that the soldier, no matter how good the ration, naturally supplements his ration by meals and otherwise out of his own pocket. It is surprising how much the young recruit patronizes the regimental institutes for additional food to satisfy his needs, and doubtless the growing lad should eat as much as he feels inclined, irrespective of all laid down principles. Variety is obtained in the ration by allowing a certain amount of commutation and daily menus are prepared by all units, based on a monthly menu issued by the supply branch of the Army. In addition, not only economy, but also greater variety and palatability has been effected by improvement in the cooking generally. During the earlier part of the war the cooking left much to be desired and much waste of food was attributable to this defect alone.

Regimental cooks are now most efficiently trained at the Army School of Administration and hospital cooks at Aldershot and the result has had a most important bearing on army efficiency.

Before commencing training as a cook, every man must be certified by a pathologist that he is not a carrier of enteric or dysentery germs, and in special cases this examination may be extended. This also applies to all men employed in the preparation of food and in both cases, men suffering from diarrhœa are ordered to report sick at once.

In preparing an army ration, one has to consider not only the energy value, but also its portability, its variety, its suitability to varying climatic conditions, its keeping properties and the kind of food men are accustomed to, among other matters. During the war in France scales of rations had to be considered for various races of mankind, but even so, the impression left on my mind was, that coloured races would readily take European food if it were offered to them, and that their diet, varying according to supply, depended largely on the necessity for consuming food that alone was available. From a long and careful study of the requirements of an army in the field in temperate climates, I am certain that the needs can best be met by a sufficiently varied diet having an energy of about 4,000 calories. Greater than this is wasteful, and less, is uneconomical also, since under stress of active service a man to be efficient in all respects must be well fed. In addition, the diet must contain a right amount of fat and a sufficient supply of fresh vegetables. In regard to the first, we should not go below seventy-five grammes of fat per man per day. There is no difficulty in this because, in a ration containing twelve to fifteen ounces of meat, there will always be an excess of fat. By good manage-

ment, suet may be utilized for puddings and dripping can replace butter to a great extent, but wastage is now prevented in the Army by saving all the waste fat, even that from the used plates, which is rendered and sold, the soldier partaking of the profit.

A sufficient supply of fresh vegetables is now insisted upon in all scales of rations and dried vegetables in lieu have been condemned.

It would here not be out of place to remark that all messing utensils used by the men after use are sterilized in boiling water, or in some cases in soap and water. The Army and Navy Canteens are bringing out a special apparatus to effect this conveniently. Table appointments have been improved and great care is exercised in the preparation and storage of food. Food safes are insisted upon for all units, and bearing in mind the danger of food poisoning, the preparation and partial cooking of food overnight and re-heating the next day before consumption is discouraged.

Hospital diets during the war were based on an allowance of each food constituent per 100 patients as originally devised by Sir Napier Burnett. This system was carried out most successfully up to quite lately when, owing chiefly to the reduction in the number of patients in each hospital a return to a fixed scale, to be regarded as a guide was made for economical reasons and convenience of working. The extras allowed, however, are considerably in excess of those before the war in spite of economy effected. With the present prices of food patients should be well fed for 2s. 7d. a day and officers for a little more.

Conclusions.

I have to some extent indicated the lines on which we have been working but much remains to be done, especially in regard to the prevention of disease among armies in the field and improvement in the general efficiency of the man as a fighting unit. During the past war many diseases hitherto unfamiliar in the field became convincingly evident, and although overcome or kept in abeyance they were nevertheless the cause of much wastage which, if only we had known, might have been prevented.

I need hardly remind you of the old saying, "In war it is the unexpected that happens." There are still problems of the late war left undetermined. Although the incidence of nephritis declined in the last year of the war we cannot say that we have satisfactorily arrived at the ætiology of the disease or have laid down adequate measures of prevention. Undoubtedly the progress of science will show the way to prevent or lessen the incidence of many diseases, such as influenza, which caused more deaths in France in a few months than did all the rest of the infectious diseases during the whole course of the war; but it must be remembered that even well considered measures of prevention dictated by science may meet serious obstacles to their success under the difficult conditions of active service in the field. No war in the future will present just the

same conditions as in the past, and it is certain that new features will be introduced which may tax our energies and zeal in the same way as formerly. In preparing for war it is useful to visualize every disease and devise a plan of campaign for its prevention, which although not complete in every detail or exactly suited to the conditions which may arise still will offer a sound basis for attack, and any modification will be met more easily than if we had not considered it at all. The occurrence of trachoma and such diseases as nephritis and trench foot rather took us by surprise, and although the measures of prevention were in part known their application was entirely new and called for exceptional measures in difficult circumstances. The chief cause of wastage from disease in the last war may be attributed to venereal disease and uncleanliness. Both of these can be prevented, and we are endeavouring at the present time to devise measures which should prevent or lessen their occurrence in the future. In regard to uncleanliness I may mention that owing to the measures taken from the very first to prevent vermin and uncleanliness the troops lately in the Near East were kept entirely free and no wastage from this cause resulted. The conditions were not quite the same as if the troops were actually engaged in warfare, but even so there would have been little complaint.

At the present time, a War Office Committee is investigating the whole question of the prevention of vermin and uncleanliness in the field, and it is anticipated that our Army in the future will be provided with both efficient cleansing sections and mobile laundries in the field and on the lines of communication, and that wastage from this cause wlll be reduced to a minimum. Other nations are also considering this question from the practical side.

I suppose that the Navy and Army medical authorities of this country will always be hampered to a certain extent by public opinion in carrying out preventive inoculation against disease. In the late war our Army was the only one in which inoculation against typhoid or vaccination against smallpox was voluntary.

There is no question that protective inoculation opens up a great field for the protection of troops on active service, and following the success of inoculation against enteric it is probable that the best results will be obtained against dysentery, still a heavy scourge of armies in the field, by a similar vaccination, whereby much inefficiency will be prevented and many lives saved.

In a report on the dysentery epidemic in the department d'Ille-et-Vilaine in France, 1921, attention was drawn to the fact that of all prophylactic measures, a vaccine given either subcutaneously or by the mouth appeared to be the most efficacious.

As an argument against vaccination it has been contended that although a very large percentage of the British troops in France were not efficiently protected by vaccination yet they did not suffer from smallpox. The truth

of the matter is that the British Army was surrounded by an efficiently vaccinated population in the shape of the enemy in front and the Belgians and French alongside and was thus protected, otherwise the occurrence of smallpox would have been inevitable. In Mesopotamia, where no protective barrier existed, the incidence of smallpox among our troops, as is now well known, became a deadly menace. I have probably had as much experience of army sanitation in the field as anyone, and I am convinced that although efficient sanitation goes a long way in prevention, you cannot under the exceptional circumstances attending active service in the face of the enemy entirely prevent smallpox, or intestinal infectious disease by sanitation alone. There are certain zones of active operations where efficient sanitation is impossible and reliance will have to be placed on protective inoculation until some further advance in science renders this unnecessary.

I will not weary you further by enlarging on a subject which is of intense interest to us all, and I am conscious that I have not put the matter before you in as clear or as interesting a manner as I could have wished, but let us remember to our satisfaction that we, whether Civil, Naval or Army hygienists, are in the happy position of representing a service which in war gains victories not by the destruction of life, but by our efforts in saving life, and that no one appreciates our work more than the sailor, soldier or airman himself, which is the best return for any self-sacrifice we make, or feeling of disappointment we may have, in working for such a result.

A REPORT ON AN OUTBREAK OF DIPHTHERIA INVOLVING THE USE OF THE SCHICK TEST.

By Major E. B. ALLNUTT, M.C.
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AND

Major R. F. O'T. DICKINSON, O.B.E.
Royal Army Medical Corps.

WITH A NOTE APPENDED

By Lieutenant-Colonel H. MARRIAN PERRY, O.B.E.
Royal Army Medical Corps.

In order to give a comprehensive account of the manner in which the occasion arose to utilize the Schick test in this small series of cases, it is necessary to summarize briefly the sequence of events in the outbreak, including the incidence of cases, local conditions, and the measures taken and recommended for its control.

The outbreak occurred in an infantry battalion quartered in barracks in the centre of a large city.

Incidence of cases showing location and dates of occurrence :—

Case No.	Barrack room	Date of incidence
1	17 D	June 7, 1923.
2	8 B	July 13, 1923.
3	23 E	August 25, 1923.
4	18 D	August 30, 1923.
5	13 C	September 8, 1923.
6	13 C	September 9, 1923.
7	1 A	September 15, 1923.

Concurrently with this incidence of diphtheria there had been a number of admissions to hospital for tonsillitis from the same unit; cases of both these diseases showed a wide distribution amongst the barrack rooms. No particular company or platoon was especially affected. Spot maps, showing all the cases, indicated that these cases were scattered over each barrack room, the spread of infection not being confined to men in beds adjacent to the patient. Presumably this was due to a high degree of general immunity, the susceptibles alone being infected. As regards the spread of infection in barracks, the sporadic incidence of most of the diphtheria cases suggested the existence of a carrier, or a chain of contact carriers, amongst the troops in quarters. To detect any such carriers, investigations were made on the following lines, with negative results at first as regards any definite conclusions.

The bacteriological examination of the throat swabs from :—

(*a*) All contacts in the barrack room.

(*b*) Any suspects, i.e., contacts from a previously infected barrack room, known to have associated with any man who subsequently developed diphtheria.

(*c*) Any diphtheria case recently discharged from hospital (convalescent carrier).

(*d*) All men found to be suffering from rhinitis, tonsillitis, or chronic enlargement of the tonsils.

Amongst the men examined was a regimental bootmaker, a possible carrier under both (*b*) and (*d*) of the above headings. From a throat swab taken from this man, organisms morphologically and culturally identical with the diphtheria bacillus were obtained. He was therefore kept in the detention ward, until the subsequent guinea-pig virulence tests showed the strain to be non-virulent. As regards the origin of the infection, apart from the spread of the disease in barracks by means of carriers, the prevalence of diphtheria amongst the civil population in the vicinity of the barracks may have been a potent factor as a source of this outbreak. Inquiries made, however, failed to trace any case in barracks to a definite source of this kind.

Local Conditions.—Some mention must be made of the immediate environment of the troops, to which special attention was at once directed in view of the prevalence of such diseases as tonsillitis.

The situation of these barracks conferred upon them some protection from road-dust, and the open spaces in the immediate vicinity of the barrack blocks were kept well watered.

The barracks occupied by this unit were built before the middle of the last century, and did not conform to modern hygienic standards of ventilation and lighting.

When to these disadvantages were added other factors, such as some degree of overcrowding together with insufficient spacing out of beds in the barrack rooms, the opportunity for the dissemination of such diseases as are usually spread by " droplet infection " was present.

It should be stated that in dealing with this outbreak one of the first measures was to urge that steps be taken without delay to remedy these defects.

The due spacing-out of beds to allow six feet of wall space to each, the allotting of the number of men only to each barrack-room as would ensure the minimum of sixty square feet of floor space per man, and such alterations to existing windows as were required to obtain adequate ventilation, were in brief the essential points dealt with.

The question of expense alone has delayed the completion of these necessary hygienic improvements.

The *General Measures* taken to prevent spread of the infection included the routine methods for isolation and disinfection, vide A.M.S.Regs., Appendix 2. All contacts were segregated and medically inspected daily for seven days, and gargling parades were also instituted after throat swabs

had been taken. Orders were issued to the effect that any man complaining of sore throat or nasal discharge should report sick at once, and from such cases swabs were taken for examination. The necessary measures were taken to ensure the immersion in boiling water of cups and other such utensils in use in mess, coffee-bar or canteen, in order to lessen the chances of the spread of infection by such means. Any suspected carriers of diphtheria were segregated in the Detention Hospital until investigations determined their freedom from virulent diphtheria organisms.

The Use of the Schick Test.—On the occurrence of three cases of diphtheria within one week in September last, it was decided to apply the Schick test in order to detect the susceptibles in the unit, with a view to their subsequent immunization with toxin antitoxin mixture, in accordance with A.M.S. Regulations, Appendix 2, para 11.

The test was carried out on September 26, 1923, upon twelve contacts from Barrack Room A 1, where the most recent case of diphtheria had occurred, all of these men having volunteered to undergo the test. The results of these Schick Tests were as follows:—

Negative reactions (acquired immunity to diphtheria), ten.

Positive reactions (susceptibility to diphtheria), one.

An anomalous reaction which was classified as a giant pseudo-reaction, one.

Of the ten negative reactions, three showed a pseudo-reaction due to protein sensitivity. These were readily detected by means of the control test. The positive reaction called for no comment, the result was clear-cut and well-defined. This patient is at present being immunized with toxin antitoxin mixture.

The anomalous reaction proved to be of the greatest interest and its probable significance is dealt with in the note by Lieutenant-Colonel H. Marrian Perry. Its interpretation materially assisted in the detection of the convalescent carrier, who in all probability was the cause of the outbreak.

It may be noted that this reaction in view of its intensity was at first thought to be a positive reaction, but the strong local reaction (redness and œdema) shown in the control test arm, which eventually developed to an equal extent and duration with the reaction in the Schick test arm, indicated rather a marked anaphylactic response. Whilst this patient was attending for his daily inspection as regards the reading of the Schick test it was noticed that he had a well-marked muco-purulent nasal discharge, and swabs taken from this discharge showed diphtheria bacilli in almost pure culture. These organisms proved to be virulent on animal inoculation. The condition of his throat was normal in appearance. In view of these facts, it seems obvious that this man had been an unrecognized case of nasal diphtheria, who subsequently as a convalescent carrier of virulent organisms was probably the origin of the sporadic cases in these barracks. His movements considered in connexion with the incidence of the most

recent of these diphtheria cases tend to confirm this view. His arrival on September 11, 1923, in Barrack Room A 1, where no previous case had occurred, was followed by a case of diphtheria in that room on September 15, 1923.

This carrier is now in hospital for treatment of his nasal and throat condition until such time when, as far as can be ascertained, he will no longer be a danger to his comrades.

It may be added that since this man has been segregated no further case of diphtheria has occurred in this unit.

Not allowing for the margin of error in dealing with such small numbers of cases, these results of the Schick test showed a percentage of susceptibles of 8·3 which is somewhat lower than the average for adults of the same age quoted by Schick, by Monckton Copeman and other authorities.

It was unfortunate that military exigencies necessitated the move of this unit on October 3, 1923, thus preventing any immediate opportunity for further investigations with regard to this series of cases by means of the Schick test. All ranks showed a keen and intelligent interest and willingness to participate in the work and there is little doubt but that the whole unit would very soon have been graded by this means into susceptibles and immunes, as far as diphtheria is concerned.

Our thanks are due to Colonel P. Evans, C.M.G., A.D.M.S. London District, for kind permission to publish this report. We are much indebted to Lieutenant-Colonel H. Marrian Perry, O.B.E., R.A.M.C., Professor of Pathology R.A.M. College, for much valuable advice and assistance with regard to the carrying out of the Schick test.

Note by Lieutenant-Colonel H. Marrian Perry.

The short series of Schick tests recorded in the above paper is of very great interest in connexion with the scientific investigation of outbreaks of diphtheria amongst military communities.

Although the movement of the unit concerned precluded the carrying out of the test on a larger group of individuals, its application resulted in the detection of a carrier of virulent diphtheria organisms, and it is understood that no further cases have occurred since the infected individual was segregated.

The details of the reaction given by the subject who subsequently was proved to harbour virulent *B. diphtheriæ* are briefly as follows:—

Within forty-eight hours following inoculation, both forearms showed a marked erythematous zone around the site of inoculation. In the case of the left arm (which had received the inoculation of unheated toxin) the affected area was tender, œdematous and markedly reddened. The right arm (which had been inoculated with heated toxin) showed the same reaction in lesser degree. These zones of inflammation gradually subsided within the next three days.

Some difficulty was experienced in interpreting the result of this reaction, as it was obvious that its intensity was greater than could be accounted for by simple protein sensitivity, and it was at first believed that it was an example of a "combined" reaction, and, therefore, indicated a susceptibility to diphtheria. Further consideration, however, led to its classification as a "giant pseudo-reaction" to which reference is made by Dudley in the Medical Research Council Special Report Series, No. 75. In that report comment is made on seven subjects who showed especially severe reactions comparable to the reaction outlined above; it was subsequently determined that all of the individuals had recently recovered from diphtheria. Dudley explained the essentially severe reactions in these cases as following on an undue sensitivity to some products present in the Schick test solutions which was induced by a recent attack of diphtheria.

Whatever may be the explanation, the bacteriological examination of swabs taken from the individual with whom we were concerned resulted in the isolation of virulent diphtheria organisms. His clinical condition and history also showed him to be suffering from nasal diphtheria. Examination of the antitoxin content of his serum, which was kindly undertaken by Dr. O'Brien, proved that he possessed 1/10 of a unit of antitoxin per cubic centimetre, an amount amply sufficient to yield a negative Schick reaction.

It is, therefore, presumed that the anomalous reaction of this individual which led to his more detailed examination and the establishment of his carrier condition, is to be explained by the development of a degree of allergie caused by repeated auto-inoculations with diphtheria toxin.

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STANDARDIZATION OF THE RED-CELL SUSPENSION IN COMPLEMENT FIXATION WORK.

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The "hæmolytic system" is used to show the positive, intermediate, and negative results of the test. It is composed of amboceptor, complement, and red-cell suspension, the actual indicator being the suspension showing complete, incomplete or absence of liberation of hæmoglobin into colour solution. The amboceptor is usually bought labelled with a certain titre, usually 1 in 1,000, but the hæmoglobin percentage and cell count of the suspension with which this titre was determined is unknown to the purchaser. The fresh complement is titrated with a fresh suspension before each batch of tests and its varying titre determined. Of the factors the only unknown one is the red-cell suspension, and if this factor can be standardized, so that from every jar of sheep's blood in citrated saline received from the slaughter-house a red-cell suspension can be made of exactly the same hæmolytic possibility for every complement titration and batch of tests, then it is certain that successive batches of tests at any interval are exactly comparable.

Every red-cell suspension made, whatever the customary percentage in use, depends on many varying details; the length of time since the blood was drawn, the type of centrifuge, its speed, the time of spinning, the number of washings, the varying amount of saline removed, these all unite in giving a final thick suspension of unknown value both in hæmoglobin content and cell numbers, without taking into account the variability which must be inherent in the blood of different sheep. The making of a percentage suspension from this resultant thick suspension multiplies these variants, and the suspension used in successive batches of tests can never be a constant.

It then became necessary to find a means of making a fixed standard suspension which can invariably be obtained each time it is wanted without adding much to the already elaborate technique of the whole test.

Red-cell counts and hæmoglobin estimations of the final thick suspension were discarded as impracticable from the time point of view, and even if done the resulting suspension was an empirical standard of personal selection and had no fixed scientific basis.

Occasional variance of reports on "split" bloods tested at different laboratories confirmed the belief that the red-cell suspension, the one factor left to chance, must be at fault.

After a series of trials, duplication and triplication of batches of tests, a

usual chance suspension was found to give very clearly-cut results. One cubic centimetre of this suspension was laked with nine cubic centimetres distilled water and sealed in a comparator tube, and henceforth each new thick suspension was diluted with saline to make it a ten per cent suspension by volume and then one cubic centimetre of it was laked with distilled water in a parallel tube until the colour matched. The ultimate suspension was then calculated and made, but it took time and was still arbitrary.

About a year ago I made the acquaintance of "Tintometer, Ltd.," the Colour Laboratories, Salisbury, and one of the Directors opened up a new field of progress during a very enlightening morning. After I had explained my ideas and exactly what I was groping for, a whole set of apparatus was lent to my laboratory and I learned the principles of colour analysis. Together we worked out the colour curves of sheep's blood and the making of a "hæmolytic constant" suspension from any citrated saline thick suspension of sheep's blood.

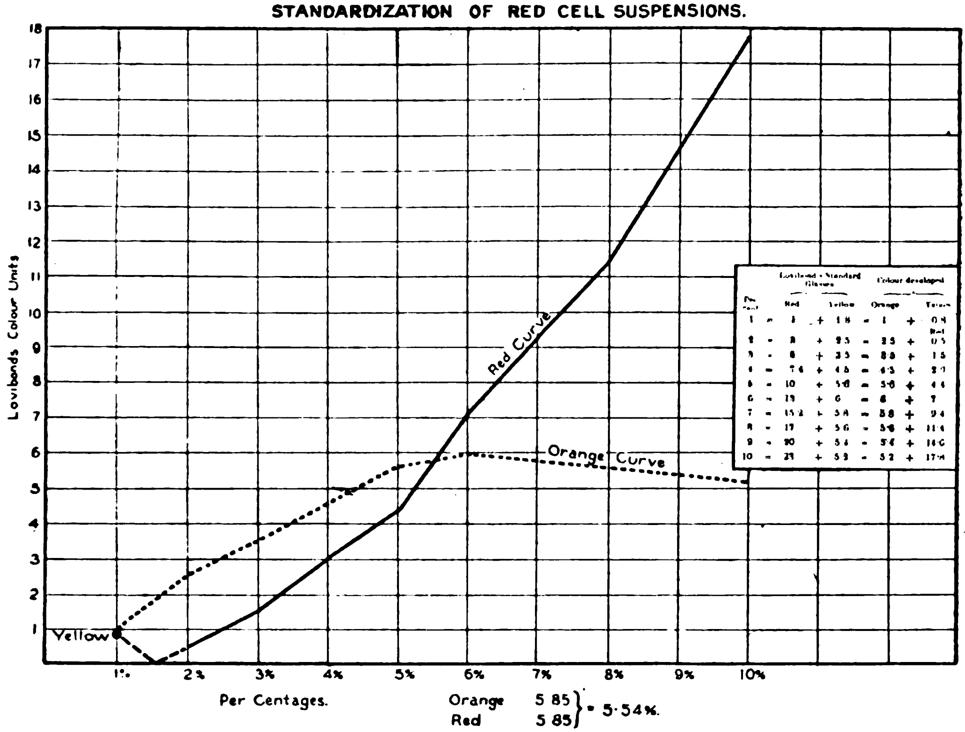
Summary of Investigation.

In a wide-mouthed glass jar containing some glass beads, a volume of one per cent sodium citrate in 0·85 per cent sodium chloride (distilled water) was placed, and a space above it for an equal volume of sheep's blood was marked. This was sterilized and stoppered. A slaughterman, following instructions, carefully let blood from the sheep's throat into the jar to the mark, gently shaking, and returned the jar to the laboratory where it was put in the ice chest and dealt with as soon as possible. After gentle shaking, the content of the jar, as much as needed, was distributed into the tubes of the centrifuge, spun for fifteen minutes, the citrated saline pipetted off, and saline added with gentle shaking. The spinning and shaking were repeated three times, the thick suspensions were poured into a cylindrical measure (after removing the last saline washing) and made up to a rough ten per cent by volume. This rough ten per cent suspension of a thick suspension of unknown hæmoglobin content and cell count is called the secondary suspension, and the thick suspension the original suspension.

One cubic centimetre of the secondary suspension was laked with nine cubic centimetre distilled water in a comparator tube (giving a $\frac{7}{12}$ inch stratum) and the colour equalled by placing red and yellow colour standard unit glass slips (superimposed) in parallel with the blood tube at the end of a comparator funnel pointed to a white tissue-covered north-light window. The red and yellow units were counted, the yellow units were subtracted from the red, and so two starting points, red and orange, were determined. A succession of laked dilutions was carried downwards, 9-8-7-6-5, etc., per cent of the secondary suspension (always using one cubic centimetre of it), and as increasing volumes occurred they were made in larger tubes and one uniform ten cubic centimetres volume transferred to the comparator

tube. There was now a series of red and orange points corresponding to the arbitrary percentages of the secondary suspension. These points were plotted on squared paper, the ordinate showing the colour-standard units and the abscissa the arbitrary percentages. The graph showed that, with the first laked dilution of the secondary suspension marked as ten per cent on the abscissa, the crossing point of the red and orange curves was at 5·54 on the abscissa and at 5·85 on the ordinate. Of course the percentages on the abscissa of an unknown content are not real, but the crossing of the red and orange curves on the ordinate is a constant because the colour-standard units are absolute constants.

STANDARDIZATION OF RED CELL SUSPENSIONS.



This crossing point "jumped to the eye" as the fixed point for the optimum red-cell suspension and the unvarying basis from which a "hæmolytic constant" suspension could always be made.

It only remained to place any secondary suspension somewhere below ten per cent and above six per cent on the abscissa to calculate its real relative percentage to the crossing point. A graph showing the red and orange curves and a table of the colour-standard units employed is appended.

Technique.—A rough 8 to 7 per cent (the secondary suspension) is made from the original suspension; 1 cubic centimetre is laked with 9 cubic

centimetres distilled water and its place determined by matching it with the colour-slips (see table). Should it be above ten per cent on the abscissa, the secondary suspension must have more saline added and the laking done again. The matching is very easy and takes very little time; a too-highly coloured laked tube can be rejected after a little practice without reference to the comparator. When the colour is matched, the slips used show the real relative percentage of the secondary suspension on the abscissa (see table). Any volume of the "hæmolytic constant" suspension can now be made from the secondary suspension by means of the following equation:—

$$\frac{5{\cdot}54 \times \text{volume required}}{\text{real percentage of secondary suspension}} \text{ and make up to volume required.}$$

For example: If the secondary suspension is found to correspond with eight per cent on the abscissa and the volume of "hæmolytic constant" suspension required is twenty cubic centimetres, then take:—

$$\frac{5{\cdot}54 \times 20}{8} \text{ of the secondary suspension and make up to 20;}$$

i.e., 13·85 cubic centimetres secondary suspension, plus 6·15 saline, makes 20 cubic centimetres "hæmolytic constant" suspension, to which after subtracting 0·1 cubic centimetre, add 0·1 cubic centimetre amboceptor (if titre is 1 in 1,000) to sensitize with 5 minimum hæmolytic doses.

As a routine each new supply of amboceptor is titrated with the "hæmolytic constant" suspension before using for tests and its real titre determined. This titre is not found to vary after two months' keeping in the ice-chest. Complement is, of course, titrated with and without antigen before each batch of tests.

At first a combination of the red and yellow colour-standard units equivalent to the crossing of the red and orange curves was used, and the secondary suspension was diluted and laked to match it by a process of "trial and error," but this proved very tedious. It was easier and quicker to change colour-slips than to make new dilutions—hence the equation.

The simple apparatus, with directions for use, is made and supplied by "Tintometer, Ltd.," Salisbury.

Apparatus.

(1) Five colour-standard unit slips corresponding to 10, 9, 8, 7, 6 per cent of the laked dilution (1 in 10) of the secondary suspension on the abscissa of the graph. A sixth slip, corresponding to the crossing of the red and orange curves at 5·54 per cent on the abscissa can be used for testing the final suspension (1 in 10 laked dilution) made by the equation.

(2) A glass tube, $\frac{7}{12}$-inch internal diameter, to contain ten cubic centimetres of the 1 in 10 laked dilution of the secondary suspension for matching with the colour-slips.

(3) An observation funnel with a holder for the comparator tube and a

slot for the colour-slip in parallel at the end. This must be pointed closely to a north-light window covered with white tissue paper.

Note.—If to an acute colour vision the laked dilution in the comparator tube should fall between two integer percentages, the real relative percentage may be taken as half-way and the equation worked out as usual.

(4) Directions for making the "hæmolytic constant" suspension from the original suspension by means of the apparatus and the equation, illustrated by an ordinary example.

Conclusions.

Of 100 successive red-cell suspensions (six per cent by volume), all required adjustment to the "hæmolytic constant" of the crossing red and orange curves of colour analysis. The technique of the routine tests was throughout Method 1, Rochester Row.[1]

If the red-cell suspension can be standardized on a definite unchanging basis, amboceptor and complement (now depending for titre on the varying hæmolytic possibility of an inconstant indicator) can always be titrated with constant accuracy, and used strictly according to titre and not in excess.

I must record my gratitude to "Tintometer, Ltd.," for their courtesy in lending apparatus to work with, which enabled me to find the fixed point on which a standard red-cell suspension could be based.

[1] Med. Res. Com., Report upon the "Standardization of Path. Methods," No. 14, Wassermann Test.

Clinical and other Notes.

A CASE OF SEBORRHŒA COMPLICATED BY PYOGENIC DERMATITIS.

By Captain J. E. MEASHAM.
Royal Army Medical Corps.

A case of chronic skin disease is frequently a source of worry to the medical man treating it, and nowhere more so than in a military hospital, where a soldier, otherwise in vigorous health, is kept from his training by some apparently trifling condition, which resists the treatment given. The disappointing results obtained are often due to the non-compliance with certain simple principles of dermatological treatment.

The following case which was treated at the Military Hospital, Chester, illustrates one or two points.

Fusilier K. was seen on November 7, 1923, and his condition after three months' treatment was as follows: He had an extensive generalized subacute seborrhœic dermatitis. His hair was thick with a good deal of scurf, but careful examination revealed the presence of a few lesions on the scalp. The most striking part of the condition, however, was a super-added pyogenic dermatitis affecting both feet, an entry in the case sheet for August 16, 1923, stating "The feet were covered with small abscesses, some of which had ruptured leaving open and discharging ulcers." The treatment given during the first three months had been directed chiefly to the foot condition, although on one occasion he had unguentum chrysarobini applied to the seborrhœic dermatitis. For the feet every sort of antiseptic bath, B.I.P. paste, and vaccines had been tried, without effecting more than a temporary improvement. Continuous applications of iodine had its advocates, but crops of pustules continued to appear. The treatment adopted in November, at Chester, was as follows: Hair of the head was cropped as close as possible with clippers. The scalp was washed daily with spirit soap and thoroughly anointed with an ointment of vaseline and lanoline in equal parts, containing ten grains each of sulphur precip. and salicylic acid, as recommended by Dr. Norman Walker. The feet were bathed daily with a dilute solution 1-8000 of pot. permang. The seborrhœa rapidly improved and the foot baths were stopped, a simple lotion of calamine and sulphur being substituted. Under this treatment all ulcers rapidly healed and the feet became quite sound. The patient was discharged to duty fourteen days after beginning the treatment, with orders to carry on the daily washing and anointing of the head, to prevent a recurrence of the seborrhœa.

Observations.—An acute affection superimposed upon a chronic skin

condition is frequently the most striking feature of the case, but the practitioner will rarely succeed in curing it unless the underlying condition is attacked as well. In this case for three months no attention seems to have been given to the seborrhœa, while many and diverse remedies were applied to the superadded pyogenic condition.

The case also illustrates the futility of applying strong antiseptics to a septic dermatitis, and the following paragraph from Dr. Mackenna's book on diseases of the skin is well worth quoting. "In suppurative skin conditions, do not aim at destroying all the organisms *in situ* by the use of strong antiseptics. Leave something to Nature and do not interfere with her functions by damaging the body tissues in an endeavour to kill micro-organisms. A pyogenic dermatitis which has resisted strong antiseptic applications will often yield to an application of calamine lotion and precipitated sulphur (eleven grains in an ounce)." The case also illustrates the importance of treating the seborrhœa of the scalp. A seborrhœa of the body usually resists all remedies applied locally, unless the scalp also is treated. In this case the seborrhœa disappeared from the body without any local treatment, as soon as the scalp was vigorously dealt with. I am indebted to Major F. S. Tamplin, R.A.M.C. O.C., the Military Hospital, Chester, in consultation with whom this case was treated, for permission to publish these notes.

A CASE OF *STAPHYLOCOCCUS (ALBUS)* SEPTICÆMIA.

By Major D. P. Watson, D.S.O.
Royal Army Medical Corps.

Reported cases of this disease being rare the following account of a case appears to be of interest.

Lieutenant M. returned from leave in Australia at the beginning of May 23. He suffered from an attack of diarrhœa with blood and mucus in the stools at the beginning of June, which cleared up under treatment in a few days. He played football on June 14, not having felt very well for several days previously. He thought he had hurt his left foot while playing this game, and as it did not get better he reported sick on the 18th. There was considerable swelling of and great pain in the metatarso-phalangeal joint of the left great toe. He was placed on the sick list and local treatment was applied. Two days later he complained of similar pain about the left knee-joint, and was found to have some fever. He was treated with salicylates and admitted to hospital on June 21.

Previous Medical History.—No serious illnesses. An attack of malaria (?) in 1919. No history of venereal disease. On admission his condition was as follows: Temperature 102° F. Digestive system: Tongue thickly coated with grey fur; breath rather offensive; bowels acting irregularly. Circulatory system: Nothing abnormal; pulse strong and regular. Respir-

atory system: Normal. Nervous system: Restless and uneasy; mental depression marked; all reflexes normal, as far as they could be tested without causing pain. Locomotor system: Left knee very swollen, tender and hot, but not red; proximal joint of left great toe still very swollen, hot and tender; the left elbow-joint and distal joint of left little finger showed a similar condition. Urinary system: No albumin or other abnormality. The condition was then considered to be one of acute rheumatic fever and he was treated with salicylates and alkalies. On June 24 the right shoulder and elbow also became stiff and painful. He was rather drowsy, but hypnotics had to be employed to secure sleep at night. On the 28th a few lymphatic glands were palpable at the back of the neck. On the 29th both ankle-joints were slightly swollen but the inflammation of the other joints was less acute. The heart sounds were noted to be less forcible. On the 30th the blood was taken for culture and proved to be sterile. On July 1, the femoral lymphatic glands were noted to be enlarged and rather tender. The heart sounds were stronger again. At this time the condition of all the joints was improving. Pain was diminishing and mobility returning. On July 5 a differential leucocyte count showed no departure from the normal except that eosinophiles were six per cent. On July 10 the left knee-joint was punctured but only a drop or two of fluid obtained, which showed no micro-organisms microscopically. On July 11 pleurisy developed on the left side, and on the 15th there were signs of slight effusion. On July 18 he passed a large stool containing glairy mucus and traces of blood. His blood was sent for agglutination test against dysentery organisms and gave agglutination 1 : 150 with Flexner W.X.Z.

It was now considered that the case might be one of post-dysenteric arthritis and as the temperature remained elevated twenty cubic centimetres of antidysenteric serum were injected on July 23 pending the result of examination of the stools. This was followed on the 28th by an urticarial serum rash.

No pathological organism was recovered from the stools. He came under my care on August 6 when his condition was as follows:—

Appearance: Somewhat emaciated, listless, with a slight icteric tint of the skin.

Joints: Inability to move the right shoulder-joint. Passive movements could, however, be carried out though accompanied by some pain and stiffness. The left elbow could not be fully extended. The left knee-joint was stiff, but could be moved through the normal arc. There was some thickening of the periarticular structures. There was thickening of the tissues round the metatarso-phalangeal joint of the left great toe. There was no grating on movement of any of the joints nor any abnormal quantity of fluid in them. The inflammation appeared to involve the tissues surrounding the joints rather than the joints themselves and subsequently the left suprapatellar bursa became inflamed and distended with fluid for

several days. The degree of pain and stiffness in the joints affected varied from time to time, one joint becoming more troublesome while another improved.

Muscular System: A considerable degree of general wasting.

Heart: No bruits; no dilatation; but deterioration of the heart muscle was evidenced by tick-tack rhythm and approximation in quality of the first and second sounds.

Nervous System: No evidence of neuritis.

Lungs: Physical signs of thickened pleura over lower half of left chest behind.

The blood and urine were cultured and an agglutination test carried out with *Micrococcus melitensis*. The results were negative except that a growth of *Staphylococcus albus* was obtained from the blood. This was considered, without justification, to be a contamination.

A few days later Major Strother-Smith, I.M.S., saw the patient with me and at once remarked on the similarity of the case to certain cases of staphylococcal septicæmia he had seen in Salonika, the suggestive points being the fugitive inflammation of multiple joints, with prolonged pyrexia and icterus due to destruction of red cells.

Another blood culture was then made and *S. albus* again recovered. A few cocci were also seen in blood smears made with special precautions against contamination.

Treatment with an autogenous vaccine was at once commenced and one dose of twenty million and three of forty million have been administered up to date. Although Lieutenant M. was apparently improving when he came under my care I believe that the injections of vaccine have already been beneficial.

Other treatment has been massage and cod-liver oil and iron and arsenic internally.

A count of red cells on September 11, 1923, showed 4,150,000 per cubic millimetre.

In the cases seen by Major Strother-Smith early intense prostration was a marked feature. In the present instance the course of the disease has tended to be subacute and there has been no imminence of cardiac failure.

Echoes of the Past.

WAS THE ROMAN ARMY PROVIDED WITH ANY MEDICAL OFFICERS?

[*Reprinted from an old book kindly lent by Dr. George Ballingall, of St. Leonards on-Sea.*]

By J. Y. SIMPSON, M.D., F.R.S.E.
President of the Royal College of Physicians of Edinburgh; Professor of Midwifery in the University, etc.

LITTLE knowledge has been transmitted to us regarding the commissariat of the Roman army. In none of our common works on Roman antiquities, as in those of Rossini, Kennet, Adams, Smith, Ramsay, etc., is there any allusion made to the question, whether or not the Roman troops were provided with medical officers. Nor does there exist, as far as I am aware, in the Roman classics, any distinct reference to the subject. I have also in vain searched among Roman medical authors, and among the writings of the Greek physicians who practised at Rome, for any direct notices, relative to the medical or surgical care of the numerous and scattered armies which Rome employed in the different quarters of the world. In fact, the only passages, with which I am acquainted, relating at all to the subject, consist of a casual remark in one of the military epistles of Aurelian; two incidental legal observations contained in the law writings of Modestinus, and in the Codex of Justinian; and a reference by Galen to the opportunities for anatomical observation presented to the physicians during the German wars.

The reference to the medical superintendence of the army by Aurelian, occurs in Vopiscus' Life of that emperor, chap. vi. In issuing some peremptory orders regarding the discipline of the army, after enumerating various rigid rules which the soldiers were to observe, Aurelian concludes with the following admonition and announcement: "Let each soldier aid and serve his fellow; let them be cured gratuitously by the physicians (*a medicis gratis curentur*); let them give nothing to soothsayers; let them conduct themselves quietly in their hospitia; and he who would raise strife, let him be lashed."[1]

When treating of those who, by absence from Rome, etc., were exempted from some burthens and taxes, the jurist, Modestinus, who wrote in the earlier half of the third century, mentions, among others, the military physicians (*Medici Militum*), "because," he adds "the office which they fill is beneficial to the public, and ought not to be productive of any

[1] "Scriptores Historiæ Romanæ," tom. ii, p. 402. (Heidelberg edition of 1743).

injury to themselves, (quoniam officium quod gerunt, et publice prodest, et fraudem eis adferre non debet.")[2]

In Justinian's "Corpus Juris Civilis," lib. x, tit. 52, there is a series of laws, "De Professoribus et Medicis." The first of these laws exempts the Physician of a Legion (*Medicum Legionis*) from civil duties when absent in the public service.[3]

The passage I have alluded to as existing in the works of Galen is to be found in liber iii, cap. 2, of his work, "De Compositione Medicamentorum pro Genera." In there discoursing regarding the treatment of wounds, he talks of the necessity of a knowledge of human anatomy for their proper management. In order to know the anatomy of man, he recommends here, as elsewhere, the anatomy of the monkey to be studied, observing that without such knowledge you cannot take due advantage of the opportunities that you may accidentally have presented to you of becoming acquainted with the anatomical structure of human bodies. And he adds, in consequence of a want of this knowledge the physicians (*οι ιατροι*) employed in the German wars, and having the power of dissecting the bodies of the barbarians, did not learn more than the cooks understand.[4]

This paragraph, though indistinct as regards the status and office of these *ιατροι*, is still sufficiently explicit as to the fact that there were physicians in the Roman army during the German wars that Galen alludes to, and which wars probably were those that occurred in the reign of Marcus Aurelius, immediately previous to the time at which Galen wrote the work from which we have quoted.

The history of other more ancient governments than that of Rome is not without allusion to the office of army physicians. Homer,[5] Herodotus,[6] and Pliny,[7] each comment on the number and fame of the medical men

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[2] "Corpus Juris Civilis Digestorum," lib. iv, tit. vi, leg. 33, sec. 2, p. 142. (Leyden edit., 1652.)

[3] "Cum te Medicum Legionis secundæ adjutricis esse dicas, munera civilia quandiu reipublicæ causa abfueris, suspicere non cogeris. Cum autem abesse desieris, post finitam eo jure vacationem, si in eorum numero es, qui ad beneficia medicis concessa pertinent, ea immunitate uteris."—*Ibid.*, lib x.; tit. 52, p. 855.

[4] Quemadmodum nec *medici* bello Germanico, barbarorum corporum insectionis potestatem habentes, amplius quippiam didicerunt eis quæ coqui intelligunt.—Kuhn's edit. of Galen's Works, vol. xiii, p. 604. Celsus speaks of the possibility of studying human internal anatomy by looking at the wounds of soldiers, etc. "Interdum enim gladiatorum in arena, vel *militem in acie*, vel viatorem a latronibus exceptum sic vulnerari, ut ejus interior aliqua pars aperiatur."—"De Medicina," lib. i, p. 8.

[5] See "Odyssey," lib. iv, v. 229, &c.

[6] "Euterpe," II, § 84; "Thalia," III, § 1 and 132.

[7] "Historia Naturalis," lib. xxvi, c. i. Pliny states that the Egyptians even prosecuted the study of morbid anatomy by dissection: "In Ægypto, regibus corpora mortuorum ad scrutandos morbos insecantibus."—Lib. xix, c. 5. Galen advised those who desired, in his day, to become acquainted with human osteology to repair for that purpose to Alexandria, for this potent reason, that there were two actual human skeletons preserved in that city. See Kühn's edit. of Galen, vol. ii, p. 220.

with which the kingdom of Egypt abounded. In describing the status and character of the Egyptian physicians, Diodorus Siculus specially states that, when engaged in military expeditions, the soldiers were treated medically, without fees; for the physicians received a salary from the state.[8]

Nor is the old classical literature of Greece without reference to surgical services tendered to the soldier in war. Homer describes the double character of army surgeons and warriors as combined in the persons of Podalirius and Machaon. And when the latter is wounded, he puts into the mouth of Idomeneus the well-known expression ("Iliad," lib. xi, v. 514), that the medical man is to the army more valuable than many warriors; knowing as he does how to excise arrows,[9] and to apply soothing medications,—

Ιητρος γαρ ανηρ πολλων ανταξιος αλλων,
'Ιους τ' ἐκταμνειν, επι τ' ηπια φαρμακα πασσειν.

In order to learn the best methods of extracting war-weapons, and to acquire dexterity in the treatment of accidents, the author of the ancient Greek treatise Περι Ιητρου, usually included in the works of Hippocrates, advises the young physician to attach himself for a time to some army, for the purpose of acquiring practical skill.[10]

In the earlier periods of Roman history and Roman warfare, the treatment of the military sick and wounded was, in all probability, trusted to the casual care of some fellow-soldiers whose tastes and inclinations had led them to pay more than usual care to the rude surgery which existed at the time. But, as early as the commencement of the Christian era, we find Celsus laying down distinct, and in many instances very excellent and practical precepts, for the extraction of war-weapons from the bodies of the wounded[11]—as of arrows, spears, leaden bullets (*glandes plumbeæ*), etc.

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[8] In expeditione bellica absque mercede curantur; medici enim annonam ex publico accipiunt."—"Bibliothecæ Historicæ" (Amsterdam edition of 1746), vol. i, p. 92. Lib. i, § 82.

[9] Homer describes three different methods by which war-weapons were extracted; viz., first, by evulsion, or traction of the weapon backwards, as in the case of Menelaus ("Iliad," book iv, v. 214); secondly, by protrusion, or pushing the instrument forward, as in the case of Diomedes ("Iliad," book v, v. 112); and, thirdly, by enlarging the wound, and cutting out the weapon, as was the practice of Patroclus in the case of Eurypylus ("Iliad," book xi, v. 218). Homer does not allude to any internal medical treatment, except once ("Iliad," book xi, v. 638), when he mentions a mixture of Pramnian wine, cheese, and flour, as having been administered by Hecamede to the wounded Machaon. (See Eustathius' "Commentarii in Homeri Iliadem," loc. cit.; and Dr. Adams' "Paulus Ægineta," vol. ii, p. 426.) Plato, in his "Republic," discourses as to whether the potion of Pramnian wine, etc., given to Machaon (whom by mistake he names Eurypylus), was not too inflammatory in its character. See "Works of Plato," Bohn's edit., vol. ii, p. 87.

[10] The treatise in question, though usually printed amongst the Hippocratic works, is not admitted to be genuine by any of the translators or commentators upon Hippocrates, with the exception of Foëes. See Dr. Adams' "Works of Hippocrates," p. 121.

[11] See lib. vii, cap. v. "Telorum ejectio."

Occasionally the weapons used in ancient war seem to have been forged for the special purpose of rendering their extraction by the surgeon a matter of difficulty and danger. At least we find Paulus Ægineta complaining that some of them have "their barbs diverging in opposite directions like the forked lightning in order that, whether pulled or pushed, they may fasten in the parts."[12]

Still, let me repeat, neither in Celsus nor in Paulus Ægineta, nor, indeed, in any other ancient medical work, have we, as far as I know, any allusion to the circumstance of surgeons or physicians being regularly appointed as army medical officers in the Roman army, for the purpose of superintending the treatment of the wounded, or, what is of still greater importance, in order to take professional care of the soldiers disabled by sickness and disease, and whose number in warfare is generally far greater than the number of those that are disabled in fight.

Modern military experience has, in many instances, proved the high importance of the services and superintendence of a medical military staff; and not so much in reference to the care of individual cases, and the cure of the wounded, as in reference to the general health and consequent general strength and success of whole armies. In fact, in war the devastations produced by sickness and disease have often been found greatly more formidable and fatal than any devastations produced by the sword; fevers, dysenteries, and other distempers of the camp, have carried off far more soldiers than the ball or bayonet; malarious and morbific agency has sometimes terminated a campaign as effectually as the highest military strategy; armies have occasionally, in latter times, been as completely destroyed by the indirect ravages of disease as by the direct effects of battle.

Nor was the experience of the Roman armies in this respect different from our own. When the Emperor Septimius Severus determined to subdue the whole of Scotland, he, about the year 208, led, according to Herodian and Dion Cassius,[13] an army of not less than 80,000 men across

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[12] Dr. Adams' Translation, book vi, sec. lxxxviii, p. 418.

[13] Xiphilin gives the following account from Dion Cassius of the various difficulties and disasters encountered by Severus, from the rivers, marshes, woods, straganems, &c., of the Caledonians: "Severus quum vellet omnem in suam potestatem redigere, ingressus est in Caledoniam, eamque dum pertransiret, habuit maxima negotia, quod silvas cæderet, et loca alta perfoderet, quodque paludes obrueret aggere, et pontes in fluminibus faceret. Nullum enim prælium gessit, neque copias hostium instructas vidit, a quibus proponebantur consulto oves bovesque; ut quum ea nostri raperent, ac longe de via declinarent, facile opprimerentur. Ad hæc nostris aquæ valde oberant dispersisque; insidiæ parabantur; quumque non possent iter facere, occidebantur a suis, ut ne ab hostibus caperentur. Itaque mortui sunt è nostris ad quinquaginta millia."—P. 305. Severus himself seems to have suffered in his health during this Scottish campaign; for, during the most of it, he required, says Dion, to be carried, on account of his weakness, in an open litter (nam plurimum propter *imbecilitatum* operta lectica vehebatur, p. 305.) Both Dion (p. 307) and Herodian (p. 153) mention his sufferings from gout; but the term (*imbecilitas*) used by Dion would scarcely seem to indicate merely an attack of this special affection.

the Forth, marched them north, apparently as far as the Moray Frith, and thence returned to York. But though, in this course, the Roman emperor nowhere met the enemy in open fight, he is stated to have lost, in this single campaign, not less than 50,000 of his troops. The marshes, fens, woods, etc., of Caledonia were more destructive to its Roman invaders, than were the long swords (ingentes gladii) and other lethal weapons borne by its warriors.[14]

We know, from the oft-repeated anecdote told by Pliny, that, in the early days of republican Rome, the practice of medicine was not encouraged among the inhabitants of the Eternal City. But, in the later periods of the empire, Rome abounded with native and foreign physicians; and when we find the Roman people exalted in so many branches of art and knowledge, we could not but expect that common experience and results, like that of Severus, would have suggested to them the propriety of increasing

[14] Herodian's account of the labours and difficulties of Severus in this campaign sufficiently indicates the sources of malaria and disease to which his army was subjected, and, at the same time, affords a curious statement regarding the condition and habits of the ancient Caledonians: "Severus' first care (says Herodian) was to throw bridges across the morasses, that his soldiers might be able to pursue the enemy over the dangerous places, and have the opportunity of fighting on firm ground; for as the greater part of the island is frequently overflowed by the tides, these constant inundations make the country full of lakes and marshes. In these the barbarians swim, or wade through them up to their middle, regardless of mud or dirt, as they always go almost naked; for they are ignorant of the use of clothes, and only cover their necks and bellies with fine plates of iron, which they esteem as an ornament and sign of wealth, and are as proud of it as other barbarians are of gold. They likewise dye their skins with the pictures of various kinds of animals, which is one principal reason for their wearing no clothes, because they are loth to hide the fine paintings on their bodies. But they are a very warlike and fierce people, and arm only with a narrow shield and spear, and a sword hanging by their naked bodies; unacquainted with the use of habergeons and helmets, which they think would be an obstruction to their wading through the ponds and marshes of their country, which, perpetually sending up thick gross vapours, condense the air and make it always foggy."—Hart's "Herodian," p. 153, 154. Dion Cassius, who lived at the date of Severus' expedition, gives, when describing the expedition, an account of our Caledonian ancestors that is in no degree more flattering. "The Caledonians," says he, "both possess rugged and dry mountains, and desert plains full of marshes. They have neither castles nor towns; nor do they cultivate the ground; but live on their flocks and hunting, and the fruits of some trees; not eating fish, though extremely plenteous. They live in tents, naked, and without buskins. Wives they have in common, and breed up their children in common. The general form of government is democratic. They are addicted to robbery; fight in cars; have small and swift horses. Their infantry are remarkable for speed in running and for firmness in standing. Their armour consists of a shield, and a short spear, in the lower end of which is a brazen apple, whose sound, when struck, may terrify the enemy. They have also daggers. Famine, cold, and all sorts of labour they can bear, for they will even stand in their marshes, for many days, up to the neck in water, and, in the woods, will live on the bark and roots of trees. They prepare a certain kind of food on all occasions, of which, taking only a bit the size of a bean, they feel neither hunger nor thirst.—Xiphilin's "Excerpta," p. 304; and Pinkerton's "Inquiry into the Early History of Scotland," vol. i, p. 438.

the strength and success of their armies, by having medical men to watch over the health of the soldiers that were fighting in so many different regions under their banners.

Some modern discoveries in Great Britain and elsewhere show that such a conjecture is not at variance with truth, and that the Roman armies were provided, at all events in the time of the Empire, with a medical staff.

MONUMENTAL TABLET
TO A ROMAN MILITARY PHYSICIAN FOUND
AT HOUSESTEADS, NORTHUMBERLAND.

Housesteads, in Northumberband (the ancient Borcovicus), formed one of the principal stations on the great defensive wall which the Emperor Hadrian reared, in the second century, from the Tyne to the Solway. Many Roman remains have been found at Housesteads.[15] Thirty years ago an embellished monumental tablet was discovered among these

[15] See Gordon's "Journey through Scotland," p. 75. Bruce in his work on the "Roman Wall," p. 214, speaks of the ancient city of Borcovicus as likely, when excavated, to prove "the Pompeii of Britain." Stukeley, in a similar spirit, declared it the "Tadmor of Britain."

remains. This tablet was, according to the inscription upon it, raised by the first Tungrian cohort to the memory of their MEDICUS ORDINARIUS. The accompanying plate represents this interesting relic, which is preserved in the Newcastle Museum. The inscription upon the tablet reads as follows, in its contracted and in its extended forms:—

D M	D[IIS] M[ANIBUS]
ANICO	ANICIO
INGENUO	INGENUO
MEDICO	MEDICO
ORD COH	ORD[INARIO] COH[ORTIS]
I TUNGR	[PRIMÆ] TUNGR[ORUM]
VIX AN XXV	VIX[IT] AN[NIS] XXV

And I append Mr. Bruce's translation of it: "Sacred to the gods of the shades below. To ANICIUS INGENUUS, Physician in Ordinary of Cohort the first of the Tungrians. He lived twenty-five years."[16]

The first Tungrian cohort, which erected this monument over the grave of their young physician, distinguished itself under Agricola, at the battle of the Mons Grampius.[17] It was afterwards, as we learn from some legionary inscriptions, engaged at Castlecary in erecting there a portion of the more northern Roman wall of Antoninus, which ran from the Forth to the Clyde.[18] Subsequently it was stationed at Cramond, near Edinburgh, and there raised an altar to the *Matres Alatervae* and *Campestres*.[19] Still later, this cohort was stationed in Cumberland; and latterly at Housesteads in Northumberland, where the momument we allude to, and several others, were erected by them.[20]

The youth of this military physician is remarkable. He died at twenty-five.

The title, "MED. ORD.," "*Medicus Ordinarius*,"[21] may perhaps suggest the idea, that there were more than one medical officer attached to the cohort; otherwise the distinctive term "*Ordinarius*" would probably not

[16] "The Roman Wall: a Historical, &c., Account of the Barrier of the Lower Isthmus, extending from the Tyne to the Solway," p. 228.

[17] "Vita Agricolæ," cap. 36 (Orellus' edit., vol. ii, p. 441).

[18] Stuart, in his "Caledonia Romana," p. 340, gives a copy of a legionary tablet found at Castlecary, and states that the first Tungrian cohort had erected 1,000 paces (mille passus) of the wall.

[19] Horsley's "Britannia Romana," p. 205. Stuart's "Caledonia Romana," p. 164.

[20] According to Horsley, it was probably under the reign of Marcus Aurelius that the Tungrian cohort became stationed at Castle-steeds, in Cumberland, where they erected an altar to Jupiter. Lastly (he adds), this cohort settled at Housesteads, where we have six or seven of their inscriptions under four or five different commanders. Here they seem to have continued till the lowest time of the empire. The "Notitia" places his cohort at Borcovicus (Housesteads).—"Britannia Romana," p. 89.

[21] It is possible the word may be a contraction for *ordinatus* (appointed), and not for *ordinarius*.

have been used. It looks as if it were in contradistinction to "*Extraordinarius*," or some similar designation.

The elaborate nature of the carving of this monumental tablet affords the strongest evidence of the esteem and respect in which this young physician was held by his cohort. In fact, it is more ornamented than many of the altars raised in this country by this and other cohorts to the worship of their gods.

It has been suggested by Mr. O'Callaghan,[22] that the animal represented on the monument is a hare, and that it was selected as an emblem characteristic of the watchfulness of the profession to which Anicius Ingenuus belonged. The Rev. Mr. Bruce supposes, more correctly, the figure to be that of a rabbit; and he conjectures that it had some reference to the worship of Priapus—a kind of myth to which antiquaries have too often referred anything that appeared unusually mysterious. The whole device is, in all probability, far more simple in its signification. The *cuniculus*, or rabbit, when found on ancient Roman monuments and coins, is generally held by archæologists and numismatists as the recognized emblem of Spain,[23] as, for example, on the coins of Sextus Pompey and Galba; and the circular bucklers or cetræ which are placed in this tablet, on either side of the animal, are equally strong characteristics of the same country. And there can be little doubt that these devices indicate merely that this young military physician was of Spanish birth and origin.

A few monumental and votive tablets have been discovered in other parts of the old Roman world, affording further evidence of the Roman troops being provided with a medical staff. In the great work of Gruter, there are copies of five inscriptions in which the physicians of cohorts (*medici cohortum*) are mentioned. There is preserved at Rome a votive tablet dedicated by Sex. Titius Alexander, physician to the fifth Prætorian cohort (Medicus cho v. pr) to Esculapius and the safety of his fellow-soldiers.[24] Another tablet, with a similar votive dedication, bears the name of "Sex. Titius Medicus Coh. vi Pr."[25]

The tablets to which I have hitherto alluded all refer to one rank of medical military men, namely, the surgeons of cohorts. It is generally believed that each cohort consisted of about 500 or 600 men, though this appears to have varied at different times; and ten cohorts formed a Roman legion.[26] From the preceding tablets, each cohort seems to have been provided with at least one medical officer, if not more. I have, however, already cited a law from Justinian's Codex, showing that there were military physicians to the Roman legions as well as to the individual cohorts

[22] *United Service Journal* for 1841, vol. iii, p. 124.

[23] See Eckhel's "Doctrina Numorum Veterum," vol. i, p. 8, and vol. vi, p. 495.

[24] Gruter's "Inscriptiones Romanæ," tom. i, p. lxviii, fig. 1.

[25] *Ibid.*, p. lxviii, fig. 2. See also *ibid.*, p. 108, fig. 4; and p. 269, fig. 3, where references are made to two others.

[26] "In Legione sunt Cohortes decem."—Cincius in Aulus Gellius, xvi, 4.

of which the legion was composed. The evidence of monumental tablets affords similar proof, that over the whole legion another, and in all probability a superior, medical officer was placed. At all events, one monumental tablet has been discovered, dedicated not to the *Medicus Cohortis,* but to the *Medicus Legionis.* It was raised by Scribonia Faustina to the *manes* of her dear husband, L. CÆLIUS ARRIAN, physician to the second Italian legion, and who died at the age of forty-nine years and seven months. The inscription in the original runs as follows:—

D M
L. CAELI ARRIAN
MEDIC. LEGIONIS
II. ITALIC. QUI. VIX. AN
XXXXVIIII. MENS VII.
SCRIBONIA FAUSTINA
CONJUGI KARISSIMO[27]

In a previous page it had been stated that nowhere in the Roman classics does there exist any distinct allusion to physicians or surgeons as forming a regular part of the commissariat of the Roman army. There are several references, however, in ancient medical and classical authors to the fact of medical men being placed in professional attendance upon the Roman Emperors during the course of their military campaigns. Galen tells us that he himself was summoned in this capacity to attend upon the Emperors M. Aurelius and L. Verus at Apuleia during their proposed campaign against some of the German tribes.[28]

A medical author (whom Galen often quotes), Scribonius Largus, has left a valued therapeutical work "De Compositione Medicamentorum." This work was written, as we are informed in the preface to it, when the author was absent from Rome, and deprived of the greater part of his library. In his History of Medicine, Sprengel states, but I know not on what precise authority, that the work in question was composed by Largus when he was absent with the Emperor Claudius during his short campaign into England.[29] Our countryman, Sir Thomas Browne, makes a similar statement. In his "Hydriotaphia," when discoursing on the want of Roman notices regarding the states, habits, &c., of the ancient Britons, he observes, "We much deplore the loss of that letter which Cicero expected or received from his brother Quintus, as a resolution of British customs;

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[27] Gruter's "Inscriptiones Romanæ," tom i, p. 633, fig. 5. The exact age of the dead, not as to years only, but as to months, as in the above tablet, and sometimes even as to days, is a feature peculiar to Roman monumental inscriptions. And nothing appears to us more strange and interesting in relation to Roman monumental tablets, than their total and absolute silence as to a future state and the possibility of meeting beyond the grave. Out of the almost innumerable Roman monumental inscriptions that have now been copied and published, not one, as far as I am aware, refers in even the most distant way to the hope of a future existence. They seem to have looked upon the idea of living in a future state of being as poetical imagery only, and not reality.

[28] Kühn's edit. of Galen, vol. xiv, pp. 649, 650.

[29] "Histoire de la Médecine," vol. ii, p. 54 (Jourdan's Translations). "Scribonius Largus vivait sous le règne de l'Empereur Claude, qu'il suivit dans ses campagnes d'Angleterre."

or the accounts which might have been made by Scribonius Largus, the physician, accompanying the Emperor Claudius, who might have discovered that frugal bit of the old Britons (mentioned by Dion) which in the bigness of a bean, could satisfy their hunger."[30]

We have already had occasion to allude to the disasters which attended the Scottish campaign of Severus, and to the imperfect health of the emperor himself during his invasion of Scotland. The evidence of Herodian further shows us, that during it he was attended by his own physicians, and that their conduct after the emperor's return from Scotland to York, whilst in the highest degree commendable as regards their faith and duty to the emperor, proved the cause of their own downfall and destruction. The anxiety of Caracalla for the death of his father Severus is well known. We have the testimony of Herodian to the fact, that while the father and son were living at York, Caracalla at one time attempted to destroy his father with his own hand. The same historian further informs us, that the unhappy son attempted to induce the medical attendants of Severus to adopt means to hasten the emperor's death.[31] He adds further, that in consequence of the court physicians not complying with his unrighteous request, Caracalla immediately after the demise of Severus, commenced his reign of bloodshed and terror by putting to death these recusant physicians of the late emperor.[32]

In the retrospect it affords a strange subject of meditation for us in the nineteenth century, to consider that, some fifteen hundred years ago, it thus happened at York, that a number of physicians were themselves doomed to death for refusing to pervert their professional trust so far as

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[30] Wilkins' edition of his Works, vol. iii, p. 467.

[31] "Medicis ministrisque conaretur persuadere, senem ut e medio quam primum quoquo modo tollerant."—Lib. iii, p. 412. The Emperor Marcus Aurelius died in Pannonia, when prosecuting a war against the German tribes. Dion Cassius alludes to the physicians who were in attendance upon Aurelius during this long campaign, when adverting to the report that the emperor's death was caused by them, in order to promote his son and successor, Commodus ("peremptus a *medicis* qui Commodo gratificabantur."—Excerpta, p. 252). But Capitolinus, the principal authority regarding the biography of Aurelius, does not allude even to the report. On the other hand, he describes Aurelius' fatal illness as one of seven days' duration, and the emperor only dismissed Commodus from his presence on the last day, lest he should communicate the disease to him. ("Septimo die gravatus est; et solum filium admisit; quem statim dimisit, *ne in eum morbus transiret*"—"Scriptores Historiæ Romanæ," vol. ii, p. 298.) The death of Pansa, the consul, at the battle of Mutina, in the year B.C. 48, is detailed by Suetonius and Tacitus in such a way as proves that Glycon attended the army as surgeon to Pansa, and took professional care of the consul when he was wounded. In fact, Glycon was thrown into prison, after Pansa's death, upon a suspicion of having posioned his wounds. (See Tacitus' "Annal.," lib. i, cap. 10; Suetonius' "Octavius," cap. 11.) M. Brutus, in a letter to Cicero, begs the interference of Cicero in favour of Glycon, and pleads his innocence of the deed imputed to him. ("Cicer. ad Brut," 6.)

[32] Lib. iii, p. 413. "Nam et medicos supplicio affecit, quod sibi parum obtemperaverant, jubenti senis maturare necem." This, as stated in the text, was one of the first, if not the first, act of cruelty which Caracalla committed after Severus' death. Dion affirms

to become the murderers of the royal invalid who had confided his health and life to their care. And the modern physician may look back with some degree of pride upon the fact that in an age and at a court where cruelty and corruption held unrestrained sway, some members at least of the medical profession remained so uncorruptible as to endanger and sacrifice their own lives rather than tamper with that of their patient.[33]

Current Literature.—Hygiene and Pathology.

Assam.—Annual Public Health Report of the Province of Assam for the Year 1922. T. C. McCombie Young, Director of Public Health. Pp. 38 + 3, 1923. Shillong: Assam Government Press. Price 12 annas = 1s. 6d.—A successful piece of work in the sphere of school hygiene may be recorded. Major E. J. C. MacDonald, I.M.S., who is Medical Officer of the Shillong schools, at the beginning of the school term performed the Shick test on 247 children and 6 adult teachers. A positive reaction was observed in 121 children and 4 adults. In the largest school, which contained 125 boarders and 14 day-scholars, all were tested but one boy, and out of 57 who gave a positive Schick reaction 56 were immunized. The fifty-seventh boy developed diphtheria before he had been immunized, as his parents objected to the operation, and he made a satisfactory recovery. At a later date a boy who had given a negative Schick test developed a very mild attack of sore throat, and non-virulent diphtheria organisms were identified in the swab. It is considered that the case may either have been one of septic sore throat in a healthy contact carrier or modified diphtheria in an immune subject. After recovery non-virulent diphtheria bacilli persisted in his throat and resisted all attempts at sterilization for some months afterwards. He was therefore present throughout the season as a "carrier," despite which only one other case of diphtheria occurred by a curious coincidence in the person of the one boarder who by oversight had not been tested by the Schick test. He also

that, after murdering his brother Geta, he ordered about 20,000 of Geta's supposed friends to be put to death; and amongst others, he condemned to death, according to Spartian, a class which is medically not uninteresting—namely, all those who wore amulets or charms about their necks, for the cure of agues, a custom which would appear to have been much in use both among the Greeks and Romans.—See Hart's "Herodian," p. 177.

[33] As a further not uninteresting record of the habits of these times, as contrasted with our own, let me add (though the topic is not altogether medical), that after Severus died at York, worn out, according to Herodian, more by grief than by disease (moerore magis quam morbo consumptus), his body was burned and the ashes left by the corpse inclosed in an urn of alabaster with perfumes (odoribus).—"Herodian," p. 413. His sons, with their own hands, lighted the funeral pile. Dion states that shortly before his death Severus sent for the urn that was destined to contain his ashes, and addressed it in terms too truly significant of the vanity and emptiness of the highest human ambition and the greatest earthly success: "*Tu virum capies quem totus orbis terrarum non cepit.*"—"Dion," p. 307.

made a good recovery. No cases of diphtheria occurred in the other two schools. Thus out of 247 children and 6 adults who were at risk, there were three cases of diphtheria during the term, viz.:—

(1) A case of clinical diphtheria in an unimmunized Schick positive case.

(2) A case of mild sore throat of doubtful nature in a Schick negative case.

(3) A case of clinical diphtheria in an unimmunized scholar whose Schick reaction is unknown.

In so far as is known this is the first attempt to make use of the Schick reaction and toxin antitoxin immunization in India. The biological and clinical evidence seems to prove that the toxin for the Schick tests and the toxin antitoxin immunizing mixture can, although not always, retain its potency after a journey to India during the hot weather months and give similarly useful results in India to those reported in Europe. A. E. H.

Food Poisoning. A. Gofton, F.R.C.V.S. *Journ. Roy. San. Inst.*, xliv., 6. November, 1923. Page 195.—A discussion, from the point of view of the food inspector, on food poisoning due to organisms of the Salmonella group in Great Britain.

The majority of such outbreaks are due to the *Bacillus suipestifer* or *aertrycke*, although Gaertner's bacillus has been responsible for extensive outbreaks through the agency of milk. Comparatively, *B. paratyphosus* B is unimportant.

The micro-organisms of food poisoning grow freely in the presence of air, and meat forms an excellent medium for their growth. They produce powerful toxins which retain their potency after exposure to temperatures sufficiently high to destroy the bacilli. The consumption of contaminated food may, therefore, give rise to an acute bacterial infection, and this is what usually occurs, but if the bacteria have been destroyed by cooking before consumption a toxæmia will result provided the toxins are present in sufficient quantity. The toxæmia, if less frequently fatal than the bacterial infection in its effects, is nevertheless serious.

Meat is the principal medium of infection in outbreaks of food poisoning, but milk and vegetables have both been incriminated, and it is noticeable that the meat food substances most frequently responsible, namely, mince, meat pies, brawn, etc., are those which are subjected to a good deal of handling in the course of preparation for sale. Brawn, meat pies, and other similar foods are, as a rule, consumed as purchased and without further preparation.

Alternative explanations of this are that the temperature attained during the cooking process has been too low, or that infection of the food has taken place after cooking was completed.

It has been shown that the food poisoning organisms are not normal inhabitants of the intestine of healthy animals, but these organisms occur frequently in association with various diseased conditions in a large variety of animals, and may occur in carriers, both animal and human. *B. aertrycke* particularly is present as a secondary infection in swine fever.

There is a difference of opinion as to the most common source of the contamination of meat from healthy animals. Savage, whose work and experience in connexion with food poisoning in this country are possibly unique, is of opinion that a small number of cases only are due to infection from human beings. In milk outbreaks the contamination may be due to cows suffering from mastitis or a general infection. In a few cases outbreaks have been traced to the use of meat from diseased animals, but his view is, that the most usual cause is the contamination of healthy meat with the bacilli derived from animals which were either suffering from disease, or were acting as carriers.

The measures advocated for prevention are mainly improved hygiene and more thorough meat inspection both before and after slaughter. The Meat Inspection Regulations which came into operation in Scotland on June 1, 1923, compel the owner of a bovine animal which has been slaughtered for emergency reasons on any premises other than a slaughterhouse and which is intended for human consumption to retain the carcase and viscera for at least twenty-four hours after notifying the local authority. It is urged that the extension of this regulation to pigs and sheep is essential. As a considerable proportion of the outbreaks of food poisoning in Great Britain are associated with pork, the procedure formerly adopted in outbreaks of swine fever is of interest. In order to minimize loss a policy of slaughter is adopted at an early stage and the whole of the healthy stock which has escaped infection is marketed for human food. Economically this is often a sound procedure, and, provided the slaughtering and dressing are done under satisfactory conditions no objection can be taken, but otherwise there is obviously considerable risk of contamination of the healthy meat.

Cutaneous Hypersensitiveness in Enteric Infections, with Special Reference to Enteric Carriers. By W. M'Kendrick (*Journ. of Pathology and Bacteriology*, xxvi, No. 4, October, 1923).—After reviewing the results obtained by previous workers, the writer states that the present investigation was carried out principally with a view to determining whether, as suggested by Thompson, the skin reaction could be applied advantageously for the detection of typhoid carriers. The series of cases investigated comprised five chronic carriers (three of *B. typhosus*, one of *B. paratyphosus* B, and one of *B. typhosus* with *paratyphosus* B infection also), fourteen cases of enteric fever, nineteen individuals who had undergone prophylactic inoculation and two with a history of enteric fever. In addition there were 360 control cases, mostly suffering from other infectious fevers.

The suspensions of *B. typhosus*, *B. paratyphosus* A, and *B. paratyphosus* B used were the Oxford standard agglutinable emulsions. A series of four intracutaneous injections were made on the patient's forearm, one with each emulsion and a control of normal saline. It is essential that these injections should be intradermal and not subcutaneous. The

dose was 0·4 cubic centimetre in the case of children, and for adults 0·6 to 0·8 cubic centimetre according as the individual had a fair or dark complexion.

In the case of a negative reaction the blebs formed by the injection were of a pink colour on the first day, on the second day still raised and crimson with pink areolæ, on the third day they were brownish yellow and by the fourth day the skin was normal or only slightly discoloured.

In the case of a positive reaction, no appreciable difference from the negative reaction was observed during the first forty-eight hours. By the third day, however, the bleb was of a dusky maroon colour, deepest centrally and disappearing on pressure. Further it was slightly indurated but not tender. These characteristics seemed to be more marked in typhoid patients and carriers than in cases of paratyphoid infections. When there had been a small hæmorrhage at the time of injection there occurred also shedding of the cutis leading to a small ulcer. On the fourth day the positive reaction was characterized by a swollen indurated plum-coloured papule with an extensive areola. No general symptoms occurred.

The results of the test in all fourteen cases of typhoid fever agreed with the bacteriologically confirmed diagnosis. In many cases positive reactions were obtained after several days of apyrexia. In no case which had ceased to respond to the skin test did a relapse occur. The reaction appeared to be specific and positive reactions were only observed at the site where *B. typhosus* had been injected.

The cases of proved carriers gave the reaction, but not always on the first test, indicating that a single negative reaction is insufficient to exclude infection.

Previous antityphoid inoculation and previous attacks of enteric fever did not give a positive reaction.

Among the control cases two gave a positive result (cases of measles and pneumonia), but no other evidence of typhoid infection could be obtained.

The test appears to be a valuable aid in the detection of the carrier and in the determination of the period of infectivity of the convalescent.

C. J. C.

Vaccination against Plague by Mouth. By M. Leger and A. Baury (*Bull. Soc. Path. Exot.*, xvi, 7, July 11, 1923, p. 469).—The authors report preliminary experiments on the immunization of animals against plague by the oral administration of bile followed by killed cultures of plague bacilli. They state that further work is necessary before it is possible to make any pronouncement as to the dosage required, the time taken to produce immunity, the duration of immunity, and the best methods of administration. A series of animals, consisting of nine guinea-pigs, two rabbits, and six monkeys, received varying quantities of bile and vaccine. Vaccine only was given to one guinea-pig, one rabbit, and two monkeys, while eight guinea-pigs, two rabbits, six monkeys and one mouse were used as controls without any immunization. Owing to variation in the virulence of plague

virus used for testing the results, considerable variation was found in the reaction of the control animals. The criterion of infection adopted, therefore, was the finding of the bacilli in the blood and organs of the animals after death or destruction. Out of all the animals which received bile and vaccine, the bacilli were found in the case of one guinea-pig only. This animal gave birth prematurely to two young ones four days after receiving the inoculation of the virus, the organism being found both in the mother and the young. It is suggested that the primary infection occurred in the young and that these re-infected the mother at birth. The animals receiving vaccine only, as well as the control animals, without exception, developed plague septicæmia.

Reviews.

HYGIENE OF THE WAR. OFFICIAL HISTORY OF THE WAR. MEDICAL SERVICES. (Vol. I, pp. xii + 400. XII; Vol. II, pp. 506.) Published by H.M. Stationery Office. 1923. £1 1s. per volume. Obtainable at H.M. Stationery Office, Imperial House, Kingsway, London, W.C.2, or Messrs. Thacker, Spink and Co., Calcutta and Simla.

HYGIENE OF THE WAR.

In war the main efforts of those responsible for the health of the troops must be directed towards the provision of pure water, sufficient food of the right quality, suitable housing and clothing, means of ensuring personal cleanliness and the innocuous disposal of refuse.

The two volumes of the "Hygiene of the War" are mainly devoted to these subjects. It is difficult to estimate accurately the saving in lives and man-power resulting from the measures taken to prevent disease, but a comparison of the incidence of typhoid fever and dysentery in former wars, and on the Western Front, amply demonstrates the value of the precautions taken in the late war. In the South African War with an average strength of 208,000 men there were 58,000 cases of typhoid fever and 8,000 deaths, whereas in the war 1914-18 with an average strength of 1¼ millions there were on the Western Front less than 7,500 cases of typhoid and paratyphoid fevers and only 266 deaths. These magnificent results cannot be attributed entirely to sanitary effort, as on the Western Front from the autumn of 1915 ninety-eight per cent of the troops were protected by antityphoid inoculation, and it might appear that prophylactic inoculation is the only preventive measure necessary against typhoid fever.

Torrens, writing on the enteric group of fevers in Vol. I of the "Diseases of the War," says "this is far from being the case and the success of the campaign against enteric fever has been in no small measure due to the unremitting care and energy of the army sanitary authorities." The

figures for dysentery, where there is no question of an efficient prophylactic inoculation, tell the same story. In the South African War the admission rate for this disease was 86 per 1,000 of strength, while on the Western Front it never exceeded 6·18 in any one year.

Perhaps the truest estimate of the value of sanitation is given by the percentage of the permissible limit of inefficiency due to sickness in the field. The figure had been established before the war as 0·3 per cent, and the percentage of sickness in France and Belgium rarely exceeded the permissible limit.

The first volume of the "Hygiene of the War" deals with sanitary organization in war, schools of instruction, water supplies in various theatres of war, disposal of waste products, housing and clothing of the soldier and the hygiene of transports.

The chapter on sanitary organization is full of interest and many points in connexion with the prevention of disease are discussed. There is an account of the development of the Divisional Sanitary Sections which played such a useful part in maintaining divisional and other areas in a cleanly state. The sections were trained chiefly by the London Sanitary Companies, and the officers were mainly non-medical men who had experience in some branch of sanitary science.

In March 1917 the sanitary sections which had been attached to Divisions were transferred to Army areas and placed under the control of the D.Ds.M.S. of Corps. The reasons for this change are fully given.

The importance of a statistical branch in the office of the D.G.M.S. of the force is emphasized. If there had been a central office devoted to a close examination of all sick returns from the armies, not only would the prevention of disease have been simplified, but it would have been discovered at an early date that fifty per cent of the hospital admissions were due to want of cleanliness.

The development of a sanitary conscience is a prime factor in maintaining a high standard of health. The medical services can advise but the maintenance of health in an army in the field depends on the effort of every arm and every individual. To this end schools of instruction were established not only at home but also in Divisional, Corps, and Army areas. The teaching was made as practical as possible and in Chapter II there is an interesting description of the methods of instruction adopted during the war. The school established at Leeds by Major Daukes may be taken as the model on which the larger schools were based.

More than one-third of the first volume is devoted to the important subject of the purification of water and the method of supply in the various theatres of war. For some years after the South African War the official method for the purification of water was to remove suspended matter by filtration through compressed sponges and then pass the clarified water through stoneware filter candles. Experience with this method on manœuvres was not happy and practically all the watercarts of this type

broke down after a few weeks' use in the field. Early in 1914 a new method was devised in which suspended matter was removed by the action of alum in a special clarifier and the clear water treated with one in a million of free chlorine derived from chloride of lime. In August, 1914, "chlorination" became the standard method on the Western Front, and later was adopted in all theatres of war. Early in 1915 all units were supplied with a special test box by which the amount of chlorine required by any particular water could be easily determined.

In connexion with a proposed advance in Flanders in 1914 water columns were formed and equipped with purification plant which delivered 400 gallons per hour. In the first plants employed water was filtered through sand and then treated with a solution of chloride of lime. Plants for the removal of poisons from water which could also be used for "chlorination" were devised and formed part of the equipment of the water columns. Later on large plants, each delivering 1,200 gallons per hour, were adopted and chlorine obtained from liquid chlorine was used as the sterilizing agent.

A full description of the working of the machines is given in Appendix "B."

Though the proposed advance never materialized the water columns proved of great assistance in many battles.

Barges delivering 4,000 gallons per hour were also equipped with similar plant and were used on the rivers and canals in France and Belgium.

The chapters on the water supply of Egypt and Palestine are of peculiar interest and indicate the important assistance which the geologist can give the engineer and medical services when troops are operating in an almost waterless country.

The remaining chapters deal with the water supply in Italy, Macedonia, North Russia, and Mesopotamia. The difficulties met with in these theatres of war are described and the methods by which they were surmounted are indicated.

The innocuous disposal of waste products ranks in importance with the provision of a pure water supply, and unless it is accomplished successfully ill-health must result. The shallow trench system of disposal, taught as the ideal some years before the war, soon proved to be impossible in the circumstances existing on the Western Front. Experiments conducted at Aldershot in the autumn of 1914 demonstrated that the waste material of a battalion could be destroyed in an incinerator of the Horsfall pattern with little additional fuel and without creating any nuisance. The staff were at first very sceptical about incineration, many of them remembering the noxious fumes evolved by incinerators having no proper baffle plate and combustion chamber. A few practical demonstrations sufficed to demonstrate the innocuousness of the new method, and in 1915, wherever possible, "incineration" became the universal method of disposing of waste material. Where incinerators could not be used as in many

trenches, and when fuel was not available, deep burial in a pit with a fly-proof cover was adopted with great success. In the chapter on the disposal of waste products many appliances are described and one is impressed with the ingenuity displayed in improvising incinerators with the material available. Considerable difficulty was experienced in the disposal of greasy fluids from cookhouses, laundries and ablution benches. Treatment of the fluids with chloride of lime or acid sulphate of soda was found helpful in many places.

The housing of the soldier constituted a problem of great difficulty in the early days of the war when camps crowded with troops seemed to arise almost in a night. From a medical point of view it was essential to prevent overcrowding, but unfortunately for economic reasons the 600 cubic feet of space and 60 square feet of floor space per man, recognized as essential from the days of the Crimean War, had to be given up and 400 cubic feet and 40 square feet per man adopted. The result was that beds in barracks and huts were placed too close together, the men being well within the maximum distance of droplet infection; the effect was disastrous when cerebrospinal fever was prevalent. Designs of huts, hospitals, operating theatres, etc., are described and the information given should be very useful in future campaigns.

The chapter on the clothing of the soldier is of considerable interest; the criticisms on the boot issued early in the war led to beneficial alterations in later issues.

The hygiene of transports assumed considerable importance during the war, as the overcrowding of ships led to much sickness during the transportation of American troops to this country. The chapter describes the arrangements made to increase the deck space per hammock and to improve ventilation. The carrying capacity of transports was thereby reduced but marked improvement in the health of the troops on board ship resulted.

The second volume deals chiefly with food rations in the United Kingdom; field rations in the various theatres of war, prevention of food deficiency diseases, and energy expenditure in relation to food and the prevention of certain diseases.

The ration of the soldier at home had to be varied in accordance with the food-supplies available in the kingdom, the caloric value of the food was gradually reduced and eventually reached a point which the medical authorities viewed with grave disquiet. Early in 1917 it was evident that a critical time was rapidly approaching when it would be necessary to know the minimum amount of food required by the soldier during training. Accordingly, Lieutenant-Colonel Cathcart and Captain Orr carried out a detailed investigation of the soldier's work; they found that the mature recruit expended 3,432 calories daily and the food supplied should therefore contain 3,775 calories. The practical result of the investigation was to show that in 1918, with every care to prevent waste during cooking and

service, the recruit received just enough food to balance the output in energy, and any further reduction in supply could not be entertained.

In this section of the volume there is a very interesting account of the work of the food economy committee, under the late Sir Napier Burnett, in relation to the feeding of patients and staff in Army hospitals. The individual unit scale per hospital patient had to be revised and a scale based on a sufficiently large number of men instituted so as to obtain a reasonable standard. There resulted a saving of 5,000 tons of meat, 4,800 tons of bread, and 2,800 tons of sugar in one year.

The description of the field rations shows how complex was the problem to be faced; many different races had to be fed and their peculiarities considered. The various dietaries employed for the different races in different climates are accurately detailed, including those of prisoners of war.

The chapter on the prevention of food deficiency disease is of great interest, and the important work carried out at the Lister Institute by Miss Chick and Miss Hume is detailed at some length.

In Chapter VI there is a description of the Military Physical Test Station established at Edinburgh. Professor Henry Briggs succeeded in developing a method of testing which quantitatively assessed fitness and stamina and seems likely to be of great use in determining whether a man is fit for training as a soldier. When men over 40 years of age were being called up it was found that only about 20 per cent were suitable for training.

The work of a base hygiene laboratory is fully set out in Chapter VII. The diversity of the problems which had to be solved is surprising.

The prevention of malaria is dealt with in Chapter VIII. The measures taken to prevent the disease are classified as (1) drug prophylaxis, (2) culicifuges, (3) personal protection, (4) mosquito destruction. Quinine was extensively used as a prophylactic but there is no clear evidence as to its value. In Macedonia medical officers regarded it as of little value. Culicifuges also had a very limited utility. On service the two chief measures to be relied upon appear to be (1) personal protection by veils, gloves, netting and the screening of buildings, and (2) skilfully planned mosquito destruction. There is no mention in the chapter of the mobile (malaria) diagnosis unit instituted by Manson-Bahr and worked so successfully in Palestine.

Measures for the prevention of cerebrospinal fever were based on the supposition that the disease spreads from man to man and that men otherwise in good health may harbour the infection in their nasopharynx and be the means of spreading the disease to others. The total number of cases (4,238) compared with the number of cases of sickness in the Army at home was remarkably few, and the loss of military efficiency due to the disease was negligible.

From his experience at home Colonel Reece believes that had it been possible on mobilization to give every man 600 cubic feet of space, and at least three feet of wall space, little more would have been required, as there would have been but few cases of cerebrospinal fever.

The chapter on the prevention of flies contains much useful information of a practical nature. The discomfort arising from flies in insanitary camps did much to develop a sanitary conscience in troops serving in the East.

The prevention of infestation with lice is described at considerable length in Chapter XII. The importance of personal cleanliness cannot be overestimated as it is now known that trench fever is propagated by infected lice. It is probable that quite 50 per cent of the hospital admissions for sickness on the Western Front were caused by lice and scabies. Steam and dry heat disinfectors were largely used, but the researches on the resistance of the fæces of infected lice to dry heat indicate that steam disinfectors would be safer on service. It is unfortunate that the illustration of the *hot-air* Russian pit disinfector should show a steam chamber. Disinfestation on demobilization was carried out so successfully that there was no importation of lice-borne disease into the United Kingdom. The importance of scabies as a cause of disease was not realized at first and it was often overlooked. Scabies complicated by impetigo was the form most commonly seen and caused much temporary inefficiency. Measures for the control of scabies were based on the results of an investigation carried out at Cambridge by Captain Munro under the direction of Professor G. H. F. Nuttall.

The chapter on the prevention of bilharziasis is of great interest and importance. At the outbreak of the war it was realized that in previous operations in Egypt bilharziasis had been the cause of considerable wastage, often prolonged over a considerable period. A Commission under Lieutenant-Colonel Leiper was, therefore, sent to Egypt to study schistosomiasis and to advise on the preventive measures. The life history of the parasite was traced by the Commission. It was found that the ciliated larvæ derived from the ova pass into species of Bullinus and Planorbis and there develop into Cercariæ which are free swimming organisms and may enter the human body either through the skin or by the buccal mucous membrane if swallowed in water. The Cercariæ are not killed by 1—1,000,000 of free chlorine in 1½ hours, but are destroyed by 1-1,000 of acid sulphate of soda. Efficient sand filtration also renders water safe. There is a misprint on page 407—1 in 300,000 of chloride of lime would give 1—1,000,000 of free chlorine, not 1-100,000 as stated.

The chapters on smallpox and plague contain little that is new and are mainly devoted to experiences in Mesopotamia. As regards smallpox it is once again made evident that if unprotected soldiers operate in a country where smallpox is prevalent an outbreak of the disease is certain to occur.

GUIDE TO FIRST-CLASS AND SPECIAL CERTIFICATES. ENGLISH. (Gale and Polden's Army Educational Series.) Wellington Works, Aldershot. Price 4s. 6d. net.

Intended primarily as a textbook for soldiers who are preparing for first-class and special certificates of education, this book is, in reality, a

comprehensive English grammar. Simple and lucid in style, it presents the subjects with which it deals in a manner that is easily understood and readily assimilated. The book will be much in demand among candidates for Army educational examinations, and it should appeal also to students outside the Army, on account of its obvious merits as a useful textbook of English grammar and composition. M. B. H. R.

Notices.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts, and commands at home and abroad.

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Journal

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Royal Army Medical Corps.

Original Communications.

THE R.A.M.C. SERVICES OF A DIVISION ON ACTIVE SERVICE.

BY BREVET COLONEL H. ENSOR, C.B., C.M.G., D.S.O.
Royal Army Medical Corps.

INTRODUCTION.

MY apology for writing on the R.A.M.C. arrangements of a division on active service is that some years have now passed since the Great War ended and so far but little has appeared describing from actual experience the arrangements which were made on the western front in France for the rapid collection and evacuation of wounded.

It is not too much to say that the excellence of these arrangements and the courage and devotion which were displayed by the R.A.M.C. and the R.A.S.C., M.T. and H.T. drivers attached to the field ambulances were admired by all who saw them and had sufficient knowledge of the conditions to appreciate the dangers and difficulties under which the work was carried out.

Our losses in officers and other ranks in action were, unfortunately, very heavy, enormous in truth for a non-combatant corps, but they were a trifle compared to the vast number of wounded men whose lives were saved as the result of these losses. If any corps ever lived up to its motto in war it is ours.

Many of our majors are now coming up for examination in Part II for promotion to lieutenant-colonel who, owing to the exigencies of the Service, had unavoidably to be employed on the lines of communication and thus had no opportunity during the late war of learning the duties of an A.D.M.S. or of a field ambulance commander from actual experience. It is

hoped that these few sections may help such officers and it is chiefly on their account that they have been written.

The arrangements recommended in certain eventualities are all founded on actual experience in the late war in France. It is not expected that they will be agreed to by all, even by the majority of officers who have had equal experience.

There are many ways by which the R.A.M.C. problems of a division in war can be solved. The chief criticism will probably be that the advanced dressing stations are recommended to be sited too far forward. The author, however, is of the opinion that such dressing stations must, at all events during offensive operations on the part of a division, be well forward and considerable risks run to establish them and to keep them open.

In war no results of value can be obtained unless risks are taken. The carry of the bearers of the field ambulances must be reduced to a minimum.

It must also be remembered that the sentence in the old Field Service Regulations which did us so much harm in the beginning of the war no longer finds a place in the new Regulations recently published. The sentence referred to is the following: "The main work of collecting the wounded takes place after the battle."

The work of our field ambulance commanders in France has rendered it impossible for this sentence to be repeated in the new Field Service Regulations.

We began the war in 1914 with the idea that advanced dressing stations should be three to five miles in rear of the infantry engaged with the enemy, although at the time we had nothing but horsed ambulance wagons as transport for the wounded. The effect of artillery fire, especially of shrapnel, was also before the war very much exaggerated. The author well remembers at an R.A.M.C. staff tour in 1913, being much taken to task by the competent military authority on the directing staff because he had sited an advanced dressing station about half a mile in rear of a battery of field artillery. The objection taken was that an enemy shell aimed at the battery might fall in the dressing station. The ideas of everybody have, however, changed, let us hope for ever, with regard to such matters.

Another criticism to be expected is that the personnel of the field ambulances cannot and should not do their own constructional work. The author is aware that in some divisions in France they did not do so, but in others, which he thinks were the better ones, they did practically the whole of the work of shell-proofing cellars, making dug-outs, repairing roads and any other work necessary for the efficiency of the R.A.M.C. arrangements.

My best thanks are due to Captain H. G. Winter, M.C., R.A.M.C., for many valuable suggestions and for his kindness in typing the manuscript, and to Captain C. F. Burton, M.C., R.A.M.C., for the trouble he has taken in drawing the diagrams.

I.—The Functions of the R.A.M.C. Services of a Division on Active Service.

The principal duties of the medical services of a division are the following :—

(1) The collection and temporary treatment of the wounded in battle, and of the sick when conditions are normal.

(2) The supervision of the sanitation of units whereby avoidable losses of officers and other ranks from disease may be reduced to a minimum.

These responsible, arduous, and dangerous duties are carried out by officers and other ranks of the R.A.M.C., by the regimental medical establishments of units, and, normally, by no other troops.

It may come as a shock to any civilian who may chance to read this section, but it can be taken as an absolute fact, that the Order of St. John of Jerusalem and the British Red Cross Society do not function in a divisional area for the purpose of carrying out the above-mentioned duties. The Y.M.C.A. does not form, and never has formed, dressing stations, their advertisements during the late war notwithstanding. These advertisements, or rather appeals for funds, took the form of pictures of wounded men being assisted by their comrades to gain the shelter of a hut which displayed the familiar triangle of the Y.M.C.A.

A few words may now with advantage be written concerning the work of a division for which the medical services are not responsible.

The medical services of a division have no responsibility whatever for the safe custody of the valuables of the dead, except of those who may die at the dressing station.

The protection of the bodies of the dead from robbery is a part of the duties of the "A" branch of the staff.

The R.A.M.C. during the late war came in for much undeserved criticism and abuse from the relatives and friends of officers and other ranks who were killed in action, and whose valuables were not forwarded home. In their ignorance they believed that all the dead were brought to the dressing stations, and at these places their valuables were stolen.

Even the editors of some of our leading newspapers must have believed that this was the case. Otherwise they would not have published the letters sent to them by the relatives of some of those who were killed, letters which directly charged the personnel of the R.A.M.C. with robbery of the dead.

The R.A.M.C. both during and after an action are too busy to wander over the battlefield robbing the dead, even if any of them were base enough to have the desire to do so.

It is strange and inexplicable that an editor of an important journal should publish the letters mentioned above, while he would not dream of publishing any letter defaming a combatant unit.

It is extraordinary, also, that in time of war the press censors should have allowed such letters to be published.

The medical services of a division have no responsibility for the burial of the dead, except with regard to those of the R.A.M.C. killed in action, and, possibly, those who die at the dressing stations. The "A" branch of the staff has this responsibility laid on it by regulations.

It must be recognized, however, that burial parties may be detailed from R.A.M.C. units for this duty, as they are detailed from other units of the division under arrangements made by the "A" branch of the staff. Burial parties will, however, be rarely required from R.A.M.C. units after an action; the units will be too much occupied with their proper duties.

The burial of the dead is, if possible, always carried out by the units to which they belong, and no good unit likes to think that its dead have been buried by any other unit, if the burial could possibly have been carried out by their own personnel.

II.—The Duties of an A.D.M.S. of a Division.

The A.D.M.S. of a division is either a colonel, late R.A.M.C., or a lieutenant-colonel with the temporary rank of colonel. He is attached to the headquarters of a division to function as the representative of the D.G.M.S., and is the adviser of the divisional commander and his staff on all technical matters connected with the medical services of the division.

He is also O.C. R.A.M.C. of the division, i.e., he commands all the R.A.M.C. units in the division—the three field ambulances and the sanitary section—and is responsible for the distribution of all R.A.M.C. personnel.

The tactical dispositions of field ambulances during operations are now provisionally decided, in so far as the area in which they are to work is concerned, by the A.G.'s branch of the divisional staff. The A.D.M.S., after having been informed of this decision and after the receipt of a copy of the divisional operation orders from the "G" branch of the staff will, after as thorough a reconnaisance of the ground as the time permits, write the R.A.M.C. operation orders. He also issues routine and standing orders to the R.A.M.C. units under his command. The question of orders issued by the A.D.M.S. as O.C. R.A.M.C., will be gone into at greater length in another section.

When active operations are in progress, or are expected, he must remain in the closest possible touch with the "G" branch of the staff. In the "G" office of a divisional headquarters a file is kept of all messages received which deal with the military situation. The A.D.M.S. by virtue of his appointment has the right to see this file, and should frequently do so. He should not expect that others will keep him informed, and the branch of the staff which can give him the necessary knowledge is the "G" branch.

In his duties the A.D.M.S. is assisted by the D.A.D.M.S., who is usually a major and acts as the sanitary officer to the division, and also as the staff officer to the A.D.M.S. inasmuch as he is empowered in the absence of his chief to issue orders in his name to the field ambulance and sanitary section commanders.

The A.D.M.S., although O.C. R.A.M.C., and as such responsible for the distribution of all R.A.M.C. personnel in the division, is not the commanding officer of R.A.M.C. officers attached for duty to regimental units. The O.sC. such units are the C.O.s of all the R.A.M.C. personnel attached to them, and they are responsible for their discipline, etc.

The A.D.M.S. has, however, full power with regard to the distribution of all R.A.M.C. personnel attached for duty to units, other than R.A.M.C. units. He can, for example, without reference to higher authority relieve an R.A.M.C. officer in charge of a battalion by one from a field ambulance.

A very important responsibility of the A.D.M.S. is with regard to the health of the troops. The question of sanitation, and the responsibility therefor, is so important that a section has been devoted to it.

The A.D.M.S. is responsible for the collection of all wounded and sick in the divisional area, and for their care and treatment while in that area. He is, under normal conditions, not responsible for their evacuation to the nearest L. of C. medical unit, usually a casualty clearing station. The evacuation of wounded and sick from the divisional area is the concern of the D.D.M.S. Corps.

If, however, conditions are abnormal and their evacuation is, for some reason or other, not being carried out, the A.D.M.S. is responsible that what can be done in this respect by utilizing the transport at his disposal is done, and also that representations are made to the "Q" branch of the staff for all available transport to be made use of for this purpose.

A *non possumus* attitude is never to be adopted by an A.D.M.S. under any circumstances connected with the evacuation of wounded.

The A.D.M.S. is responsible for the correct rendition of any returns which may be required of him by the D.D.M.S. Corps and by the divisional staff.

The "A" branch of the staff must be informed daily, or as often as the conditions permit, of the names and units of all officers and the total numbers, by units, of all other ranks who have been evacuated to the L. of C. from the field ambulances, or who have died while under treatment in these units.

Only one more of the many duties of an A.D.M.S. will be referred to. It is that he must at all times be helpful and courteous to all who ask for his assistance or advice, particularly so to his own officers. He is attached to headquarters so that he may be in close touch with all that is taking place, and is thus in a position to give information, except of course information which must be kept secret, to those who apply to him for it to enable them to carry out their duties intelligently and efficiently.

Rudeness to officers, and others, who seek information and instructions is more often than not a cloak for ignorance.

III.—The Orders issued by an A.D.M.S.

The A.D.M.S., as O.C., R.A.M.C., issues operation, routine and other orders for the R.A.M.C. units of the division.

With regard to operation orders for the R.A.M.C.; these orders are written by the O.C. R.A.M.C., based on the copy of the divisional operation orders which he will receive from the "G" branch of the staff. Previously it will have been decided by the "A" branch of the staff, after consultation with the "G" branch, in what areas the field ambulances will work. In all divisions, where the R.A.M.C. services in battle are considered to be of importance, the A.D.M.S. will be present at this consultation so that he may be given an opportunity of stating his views on the medical situation.

The R.A.M.C. operation orders for a deliberate attack, or when the division is on the defensive, or when a deliberate retirement is to be carried out, should state where the advanced dressing stations, the main dressing station, and the walking wounded collecting station are to be sited; what field ambulances are to be responsible for them and for the collection of the wounded from the troops they will serve; how the motor ambulance transport for the division will be organized; what field ambulance or part of a field ambulance will be kept in reserve and where.

These R.A.M.C. operation orders must not be issued until they have been seen and approved by both the "G" and "A" branches of the staff. When approved, copies should be issued to the three field ambulances and also to the headquarters of the three infantry brigades, the C.R.A., C.R.E. and O.C. R.A.S.C., so that they may be informed as to the positions of the dressing stations, etc., and in turn inform their units of these arrangements.

Operation orders should be carefully written so as to be in uniformity with the directions given in the Field Service Regulations.

In the event of a rapid pursuit of the enemy, R.A.M.C. operation orders can contain little detail. Field ambulances will be ordered to serve, and keep in touch with, let us say, certain infantry brigades. The formation of the dressing stations must be left to the initiative of the field ambulance commanders. The same holds good in the event of an unexpected retirement on the part of the division.

The A.D.M.S. must bear in mind that at the beginning of a campaign his field ambulance commanders will require more detailed operation orders than will be necessary after they have become experienced in the handling of their units in battle. It is laid down in Field Service Regulations that nothing is to be given in operation orders which the recipients can be expected to know. If there is any doubt on the matter, it is better for the A.D.M.S. to give instructions in detail than to find afterwards that his expectations with regard to the knowledge possessed by his officers have been too optimistic.

Routine orders issued by the A.D.M.S. deal with discipline, matters of

internal economy of the R.A.M.C. units, moves of officers and other ranks of the R.A.M.C., and are similar to those issued by a D.D.M.S. of a command in peace time. A copy of such orders should be sent to all O.sC. units to which R.A.M.C. officers are attached, if such orders concern them.

Standing orders for the R.A.M.C. of a division should be drawn up and issued, after approval by the "A" branch, as soon after mobilization as possible. These orders should deal with the evacuation of the sick and wounded on the line of march; the procedure to be adopted with regard to the clerical work by the field ambulances when the division is in action; the returns required by the A.D.M.S., when the situation is normal, and when a battle is in progress.

It is always useful to have such matters issued in standing orders, which can be added to from time to time when experience shows such additions to be necessary.

Orders with regard to sanitation are not issued by the A.D.M.S.; not being a staff officer he has no power to issue them. He makes recommendations on such matters to the "A" branch of the staff and such recommendations, if approved, are published in divisional routine orders.

IV.—The Field Ambulances.

The field ambulances of a division are three in number and the composition of these units is given in detail in Provisional War Establishments, Part XXIII, A.

The present field ambulance can briefly be said to consist, including attached personnel, of eleven officers and 222 other ranks. Of this number ten officers and 161 other ranks are R.A.M.C.; of the attached one is an officer of the Army Dental Corps, and the great majority of the remainder belong to the R.A.S.C.

A field ambulance consists of its headquarters and 2 companies, while its ambulance transport comprises 4 heavy horsed ambulance wagons, 6 light and 2 heavy motor ambulance cars.

The field ambulances are divisional troops under the command of the O.C., R.A.M.C. who is the A.D.M.S. of the division. These units have for many years been divisional troops but the belief that they belonged to infantry brigades was very much alive at the beginning of the Great War, and has not yet quite died out. This belief was encouraged by giving the field ambulances the same numbers as the infantry brigades—for instance, the 8th Field Ambulance, III Division, would appear by its name to belong to the 8th Infantry Brigade of that Division.

At the beginning of a war field ambulances suffer from the same grave disadvantages as all other R.A.M.C. units—i.e., that on mobilization all such units have to be formed *de novo*. No R.A.M.C. unit serving in peace time, in so far as the regular army is concerned, can take the field as one of the R.A.M.C. units of an army. This is a very great disadvantage, especially as regards the field ambulances, as the officers and other ranks of a newly

mobilized field ambulance are for the most part unknown to one another, and the duties they will have to perform in war are also in many respects widely different to the duties they have been accustomed to in peace.

This being the case, as high a degree of discipline, particularly march discipline, efficiency, etc., cannot be expected from a newly mobilized field ambulance as from, let as say, an infantry battalion whose mobilization consists chiefly of filling up the ranks with reservists, arming and equipping them, and then taking the field with the majority of its serving personnel intact.

A newly formed field ambulance, however, commanded by a good officer who has taken the trouble to study the military side of his profession, will very soon become efficient, and as well disciplined and as smart in appearance as any unit in the division, if not more so. A field ambulance commander must never lose sight of this disadvantage from which his unit will suffer at first, and he must devote all his own and his officers' and most of his men's spare time to instruction.

The duties of a field ambulance commander are laid down in R.A.M.C. training; all that will be given here will be remarks on matters which the experience of the late war has brought to notice.

A field ambulance commander may be required to form one or more advanced dressing stations, a walking wounded collecting station for the care of slightly wounded troops, or a main dressing station to which all the seriously wounded of the division to which he belongs will be transported for treatment, pending evacuation to the casualty clearing station serving the division.

Advanced dressing stations will, in the case of a deliberate attack being undertaken by the division, or when the division is on the defensive both in open and position warfare, be sited, normally, by the A.D.M.S., the approval of the "A" and "G" branches of the staff having first been obtained. The personnel to be employed at each advanced dressed station will also be decided by the A.D.M.S. This information will be embodied in the operation orders issued by the A.D.M.S. in his capacity as O.C. R.A.M.C. to the field ambulance commanders.

In the event of an encounter battle there will be no time for the leading field ambulance commanders at any rate to receive orders from the A.D.M.S. and, in any case, the A.D.M.S. not having had an opportunity of reconnoitring the ground should not fall into the mistake, so fatal to the R.A.M.C. arrangements of a division, of siting the dressing station by merely choosing what appear on the map to be suitable positions. The advanced dressing stations in an encounter battle must be sited by the field ambulance commanders themselves and the map references sent at once by motor cyclist to the A.D.M.S.

The site chosen for an advanced dressing station in open warfare should be one that is not under the direct observation of the enemy from the ground; should be on a good road; in good buildings when possible;

have its own water supply; have facilities for cooking, etc., and should not contain a large quantity of inflammable material such as hay or straw. During an action an advanced dressing station may expect to get a shell or two into it which will probably not do much harm. It will, however, be a different matter if barns full of hay and straw are being used for the accommodation of serious cases.

Whenever it can be arranged, one of the advanced dressing stations of a division, and preferably one on the main road of evacuation, should be large enough to be made into a divisional main dressing station in the event of a rapid advance following a victory.

A farm about fifty or a hundred yards off the main road often appears to be an ideal place for an advanced dressing station. Before deciding to use it for this purpose, however, examine carefully the road leading to the farm from the main road. If it is metalled, well and good so long as there is room on the road for cars to pass each other and turning space on the lee side of the building. If it is merely a cart track, be careful. It may be quite good enough for motor ambulance cars whilst the weather remains dry but be quite impossible for cars if it comes on to rain. The weather is usually wet when the British Army is making an attack.

An advanced dressing station must be an advanced dressing station, in other words it must be well forward, especially when the division is going to attack the enemy; only when the division is on the defensive is it justifiable to site it a considerable distance in rear so that an initial success on the part of the enemy does not render it at once untenable. It should, when an attack is about to take place, be sited somewhere in the zone between the firing line and the forward field artillery positions. It will certainly be within long rifle range of the enemy but that matters little; a few "overs" from the enemy will not do much harm.

In open warfare the windows on the weatherside of the building, i.e., the side exposed to the unaimed fire of the enemy, should always be blocked by sandbags to a height estimated to give protection from shrapnel and rifle bullets and, for this purpose, a field ambulance commander should always take care that he is provided with an adequate number of sandbags.

In position warfare advanced dressing stations should be sited in the battle zone of the division and must be proof against the enemy's light and medium artillery. They should be established in dug-outs with two or more entrances, and must be on a track or road practicable for motor ambulance cars. In open warfare their position will vary according to whether the division is about to take the offensive or is on the defensive. It is most important that accommodation be provided for at least twenty stretcher cases as evacuation may be held up for a time owing to heavy shelling of the roads.

Advanced dressing stations must display the Union Jack and the Red Cross flag in the prescribed manner by day and the distinguishing lights by night. These are displayed for the information and guidance of our own

troops. It is simply asking for trouble to display them in such a way that they can be visible to the enemy from the ground. In war neither side can afford to trust the other—Geneva and Hague Conventions notwithstanding.

One of the most important things for a field ambulance commander to bear in mind in action is that his bearers must not be allowed to become exhausted. The duty of the bearers in his companies is to clear the regimental aid posts of their wounded. The carrying of heavy men on heavy stretchers is very exhausting work, and the carry of the bearers must be made as short a one as possible. This can be arranged by forming what are generally known as bearer collecting posts.

A bearer collecting post should be formed under good shelter, or in trenches, at a place about half-way between the regimental aid posts and the advanced dressing station. In open warfare it should, if well sited, serve two regimental aid posts. The wounded are brought to this place by the field ambulance bearers and transferred from it to the advanced dressing station by means of wheeled transport, light cars or horsed ambulance wagons.

The bearer collecting post must be on a road or track practicable for wheeled ambulance transport; if no such track is available one can be marked out, and with a little work made practicable for horsed ambulance wagons at least.

An officer of the company of the field ambulance concerned should invariably be in command of each bearer collecting post to supervise the work of the bearers and to carry out any treatment urgently needed. Food and the materials for making tea for the personnel should always be provided at these collecting posts.

Clerical work at the advanced dressing stations must be reduced to a minimum. All that should be done at such places is to make out the field medical cards, and to record on them the nature of the injury, and the amount, if any, of morphia given. A record of the particulars of all cases brought in dead, or who die in the advanced dressing stations, must also be kept.

The main dressing station of the division must always be sited by the A.D.M.S. and approved by the "A" branch of the staff. It should be placed on a main road of evacuation, and should be beyond the range of the enemy's medium artillery. It must be large enough to accommodate large numbers of wounded in the event of any hitch occurring with regard to the evacuation of wounded from it to the casualty clearing station by the motor ambulance convoy working under the orders of the D.D.M.S.

Large modern schools make excellent sites for main dressing stations. If possible the site should be one that is suitable for a casualty clearing station in the event of an advance being made as the result of a victory.

The staff of a main dressing station should normally consist of the headquarters of a field ambulance supplemented by any other troops available. The personnel of the headquarters cannot be employed in

unloading ambulance wagons arriving at the main dressing station; they have other and far more important work to perform. The duty of unloading ambulance wagons and carrying the wounded to the reception ward should be carried out under the supervision of a senior N.C.O. R.A.M.C., by men obtained through the "A" branch of the staff from labour units, etc., or supplied by the D.D.M.S. Corps; chronic cases of venereal disease can with advantage be employed on this duty. Personnel from fighting troops in reserve should never be so employed. The work required is very hard, and after a few hours of it the men become exhausted and have to be relieved.

The main dressing station must be carefully organized as it is at this place that the great majority of surgical operations, absolutely necessary to be performed at once, are carried out. A large proportion of all the clerical work incidental to an action will also have to be done at the main dressing station.

It has been mentioned above that the clerical work at the advanced dressing stations must be reduced to a minimum. The necessary entries in the Admission and Discharge Books of the unit staffing a main dressing station should not be made out at once. The particulars of cases brought in should, in the first place, be taken down by clerks in the reception ward on A.F.s W. 3210 and later copied into the A. and D. Books. An A.F. W. 3210 should be used for each case admitted and, when the entries have been made in the A. and D. Books, they should be arranged in bundles by units and forwarded to the O.C. units as a record of the casualties their units have sustained, and also to enable them to make out their A.F.s B. 213.

The A.D.M.S. will also require at intervals of four to six hours the names of officers, and the total numbers of other ranks by units, who have been admitted to the main dressing station. This information will be passed on to the "A" branch of the staff.

One of the most important of the many items of organization required of the O.C. of a main dressing station is to make adequate arrangements whereby motor ambulance cars bringing wounded from the advanced dressing stations are re-equipped with an equal number of stretchers, blankets and splints, to replace those removed with the wounded. If this is not done, after a comparatively short time, the main dressing station will be in possession of most of the stretchers, etc., of the field ambulances engaged in the battle, with the worst results so far as the R.A.M.C. arrangements are concerned.

It is obvious that to enable this exchange of equipment to take place between motor ambulance cars and the main dressing station extra stretchers and blankets, etc., must be provided at the main dressing station. The provision of such extra equipment will be, normally, the care of the D.D.M.S. who will inform the A.D.M.S. before an action, where it can be obtained.

The divisional walking wounded collecting station will next be briefly considered. This station, if the nature of the expected fighting makes it necessary to provide one, will be sited by the A.D.M.S. and its position communicated by the R.A.M.C. operation orders to the troops. It is most important that its position should be made well known to the Military Police and men employed on traffic control so that they may be in a position to direct slight cases to it.

The walking wounded collecting station should be sited on or near a main road of evacuation; it should be beyond the range of the enemy's light artillery. The staff required should seldom exceed an officer, two N.C.O.s and four privates trained in nursing duties, two clerks and a cook. The field ambulance to detail this personnel will be ordered to do so by the A.D.M.S. It is designed for the temporary care and treatment of slight cases and the particulars of all cases admitted must be entered in the A. and D. books of the unit detailed to form it. The same procedure as outlined for the clerical duties at a main dressing station should be followed.

The A.D.M.S. will, at stated intervals, also require the names and units of all officers and the numbers of other ranks who have passed through it for the information of the "A" branch. This branch of the staff on receipt of the above information from both the main dressing station and the walking wounded collecting station will be able to form a fairly accurate idea of the number of casualties the division is sustaining.

The wounded, after their "particulars" have been taken and their wounds dressed, if necessary, should be provided with a meal and hot soup or tea while awaiting evacuation. They will almost certainly prefer tea to soup.

The evacuation of the wounded will be carried out by means of transport provided under arrangements communicated through the "Q" branch of the division.

A walking wounded collecting station is, as mentioned above, only established for the reception of slight cases. A field ambulance commander responsible for one must always bear in mind that inevitably seriously wounded men will manage to arrive at it. For such cases motor ambulance transport must be available at, or near, the station.

In open warfare a walking wounded collecting station should be established in some more or less prominent building which is on, or near, a main road of evacuation, but is not in, or near, a village. If possible it should be a place likely to be known to the troops.

In position warfare the author is inclined to recommend strongly the use of tents, if available. They can be pitched the night before a division delivers an attack, or, when on the defensive, an offensive on the part of the enemy is expected; they can, if proper arrangements have been made, be pitched as soon as it is known that an attack is in progress. Tents so used must, of course, not be in view of the enemy on the ground. It has been found by experience that such tented collecting stations are rarely, if

ever, shelled by the enemy until forty-eight hours have elapsed. This is the time it probably takes for the hostile aeroplanes to develop their photographs, and to locate them, and to get the information out to their artillery. If a walking wounded collecting station is still required after the lapse of forty-eight hours it should be moved to a position about half a mile distant from its first site. The personnel may then have the satisfaction of seeing the abandoned site heavily shelled by the enemy's medium artillery.

A field ambulance commander must be always alive to the necessity of taking every opportunity of improving the discipline and efficiency of his unit. When his unit is withdrawn with other troops from the line for a rest, or is halted for a few days, the equipment should be carefully gone over and checked and brought up to scale. The whole unit, even attached R.A.S.C. personnel, should be instructed in first-aid and no N.C.O. or man of the R.A.M.C. personnel should be unable to apply a "Thomas" splint for the treatment of gunshot fracture of the thigh. Corps drills and exercises should be carried out, and the men instructed in the use of their gas masks and practised in marching while wearing them. In short the camp of a field ambulance withdrawn from the line, or halted for a few days under quiet conditions, should resemble a camp of instruction. It is not meant that the men should be overworked. They should be well fed and amusements provided, but they should have enough of work to keep them healthy and happy. Idle men are always discontented.

A field ambulance commander must always be prepared to carry out all necessary work with the personnel of his unit. He should not expect, or request his A.D.M.S. to obtain help from the R.E. unless the work is of a very technical nature. All work in connexion with the throwing up of cover, digging trenches for the protection of the wounded and his own personnel, repair of roads and tracks to enable them to be used by motor ambulances, the strengthening of buildings used as advanced dressing stations, etc., should all be undertaken and carried out by him by making use of R.A.M.C. personnel of his own unit. To enable this work to be done efficiently the trades of the men in his unit should be noted, and it will probably be found that a proportion are miners in civil life and as such excellent men to employ on the making of dug-outs, and to instruct other men in this most useful art in position warfare. There will also be a number of men who are carpenters or have some knowledge of this trade.

Indents for materials should be sent, normally, to the headquarters of the C.R.E. When authority for issue has been obtained, all material indented for must be drawn by the personnel and transport of the unit.

V.—The Regimental Medical Officer.

The duties of the R.A.M.C. officer in medical charge of a battalion in action are very responsible ones.

Upon him is laid the duty of clearing the line of wounded, and of their temporary care and treatment at the regimental aid post pending their evacuation to the advanced dressing station.

To enable him to carry out these duties he is provided with adequate medical and surgical equipment, and, before an action begins, the regimental stretcher bearers are placed under his orders. These stretcher bearers should all be familiar with first aid to the wounded, and everyone, without exception, should be capable of applying a "Thomas" splint for the treatment of gunshot fracture of the femur. Before the action begins, they should be provided with their "S.B." badges, stretchers, splints, etc., and distributed amongst the companies to which they belong.

It is laid down in Field Service Regulations that regimental stretcher bearers are to be supplemented by an equal number of bearers drawn from the ranks of the unit, when it appears probable that the casualties will be heavy during the action. The additional bearers are to be kept as a reserve at the regimental aid post until required; they must be provided with stretchers. Application for the additional stretchers must be made to the O.C. of the field ambulance on whom the responsibility of the clearing of the regiment aid post is laid.

The regimental aid post to which the wounded will first be brought is to be in some place near the battalion headquarters so that the officer in charge can be easily informed as to the progress of the action. In open warfare it should be in a place not under the enemy's direct observation from the ground, and should be protected from rifle and shell-fire as much as possible. Whenever it can be arranged, it should be on a track practicable for the light ambulance cars so that when opportunity offers it may be cleared by means of these vehicles.

In position warfare it should be sited in a convenient cellar, or dug-out, capable of accommodating at least nine stretcher cases awaiting removal.

The responsibility for the siting of a regimental aid post is laid on the unit commander who, in consultation with his R.A.M.C. officer, should select a suitable position. The making of it shell-proof in position warfare is also the concern of the unit, and not that of the field ambulance which may at the time be clearing it.

In both varieties of warfare a reserve dump of at least twenty stretchers should be available at a battalion regimental aid post, these reserve stretchers having been obtained from the field ambulance responsible for clearing the aid post.

During an action the regimental stretcher bearers after applying first-aid to cases unable to walk bring them to the aid post where they are inspected and redressed, if necessary, by the officer in charge, the appropriate tally applied, and if morphia has been given the dose recorded. These cases are then taken from the regimental aid post to the advanced dressing station by the bearers of a field ambulance company allotted to the aid post for duty.

The responsibility of the regimental stretcher bearers is to bring the helpless cases to the aid post, and no farther. Having brought in cases they should receive a stretcher from one of the field ambulance bearer

squads detailed for the duty of carrying cases from the aid post to the advanced dressing station, and at once return to their companies to bring in more wounded.

Seriously wounded men, who are able to walk after they have been dressed at the aid post, should be sent to the advanced dressing station in the charge of a field ambulance squad carrying a stretcher case.

Slightly wounded men, who are no longer able to fight, are to be directed to the walking wounded collecting post.

In the event of the battalion advancing, the regimental aid post must be moved forward to a position where it can again be in close touch with the firing line and the battalion headquarters.

The duty of informing the field ambulance bearers of the change of position is laid by regulations on the regimental medical establishment. There should be no difficulty about this. The necessary information can be sent in writing by the officer in charge to the O.C. ambulance company concerned by means of the R.A.M.C. bearers taking cases to the advanced dressing station.

Prisoners taken by the battalion should be made use of in clearing the aid post, and for this purpose the dump of reserve stretchers mentioned above will be very useful.

The officer in charge of a battalion aid post should, before an action, arrange for the essential equipment of a regimental aid post to be prepared and packed in sandbags, which can be easily handled and carried, for use when the time comes for the aid post to be moved.

An aid post should have a small red cross flag so displayed as to be visible to the men of its own unit, but not to the enemy.

The proper position of the officer in charge during a battle is at the aid post of his unit. It is there that he can do most good, and it should be rarely necessary for him to go in person to supervise the collection of the wounded by the regimental stretcher bearers.

After a considerable advance has been made on the part of the battalion, and the aid post has been moved forward, the regimental stretcher bearers must be moved forward with it, and again get in touch with the attacking troops. The duty of clearing any wounded not yet collected in the area over which the battalion has fought is laid on the field ambulance company working in that area.

In the event of a battalion being obliged to retire, its regimental aid post is also to retire, and to establish itself in some suitable place in the rear. The officer in charge of a regimental aid post during a retirement must on no account stay with any wounded who have not been cleared. His duty is to retire with the battalion, and not to remain with the wounded to be captured by the enemy. It is not a pleasant thing to have to leave our wounded to the care of the enemy, but in war, on occasions, there is no help for it.

The clearing of wounded from artillery positions during an action as a rule does not present much difficulty.

In many cases an artillery brigade will come into action close to an advanced dressing station to which it can send its wounded direct by means of its own stretcher bearers. In other cases the A.D.M.S. should arrange for a light ambulance car to be posted at some convenient place to which the wounded can be brought, or, if practicable, the car can be sent on demand to clear the artillery aid posts.

Artillery aid posts should be established on or near a road or track, and at some little distance to the flank of the brigade so as to avoid the counter battery fire of the enemy. In open warfare as a rule this fire will be inconsiderable.

VI.—Sanitation.

The importance of sanitation in the field cannot be over estimated. It is correct to say that in all wars previous to the Great War deaths from disease easily outnumbered the killed, including those who died of wounds received in action. In the late war it was only on the western front that the number killed in action and died of wounds exceeded the deaths from disease. In the minor theatres of war deaths from disease were the chief causes of the mortality amongst the troops.

Neglect of sanitation is invariably followed by outbreaks of preventable disease, and the loss of highly trained soldiers who may not be easily replaced. Many campaigns in the past have been prolonged, or lost, owing to disease amongst the troops, the result of defective sanitation.

The D.A.D.M.S. is the sanitary officer of a division, but he has other duties to perform, and in war he cannot possibly advise units as to the siting of camps, arrangements for water, etc.. Chapter XIII R.A.M.C. Training was written, it is believed, when it was imagined that a sanitary officer, with no other duties than those of supervising and advising with regard to sanitary matters, would be attached to the headquarters of each division.

The duties of the D.A.D.M.S. as sanitary officer of the division, are now generally recognized to be confined to giving advice on special sanitary questions, investigating outbreaks of infectious diseases, and recommending the measures necessary to prevent their spreading amongst the troops.

In both peace and war all R.A.M.C. officers are sanitary officers, more particularly so in war. Advice with regard to the sanitation of billets and bivouacs must be given to the O.sC. units by the regimental medical officers, and, in the case of units not having a medical officer, by the field ambulance officers in the area or by the R.A.M.C. officer who sees the sick of such unit.

Cases of infectious disease occurring amongst the troops of a division on active service cannot, as a rule, be definitely diagnosed while they are with the division, but such cases, when diagnosed by the L. of C. medical units, are immediately reported to the A.D.M.S., and he will order the

cause of their occurrence to be carefully inquired into, and the necessary means for the prevention of further cases to be taken.

The A.D.M.S. of a division has no power to order measures calculated to improve the health of troops; he has only power to advise the responsible branch of the staff, the "A" branch, as to what should be done, and his recommendation should take the form of drafts for insertions, if approved, in divisional routine orders.

In the same way, in local sanitary questions, the R.A.M.C. officers attached to units can only advise the unit as to what should be done.

After the recommendations have been made, either by the A.D.M.S. or the officers in medical charge of units, the responsibility rests in the first case with the "A" branch of the staff, and in the second with the C.O.s concerned. The C.O. of every unit is responsible for the sanitation of the area occupied by his unit, irrespective of the period of occupation, and an R.A.M.C. officer attached to a unit is responsible to his C.O. that all needful sanitary measures are brought to notice by him, and that the sanitary squad and water duty personnel carry out their duties under his supervision.

It is of the greatest importance that all the recommendations he may make should be in writing, and that copies of all such recommendations should be kept by him. In the event of no action being taken on such recommendation it is the duty of the officer in medical charge of the unit to bring the matter to the notice of the A.D.M.S. This is an unpleasant duty, as it amounts to a junior officer reporting his C.O.; it must be done, however.

The chief means by which R.A.M.C. officers can help to win a war are by preventing the depletion of the ranks by disease, and by improving the morale of the troops by the rapid collection and treatment of the wounded.

An officer should be very careful only to recommend such sanitary measures as are practicable, having regard to the military situation. Impracticable recommendations only bring discredit and ridicule on the R.A.M.C.

A few words may not be out of place here with regard to a divisional sanitary section.

The divisional sanitary section is a small but most useful unit. The principal functions of a sanitary section are the following:—

(1) Inspection by its trained N.C.O.s of the sanitation of units.

This inspection must never be carried out without the O.C. of the unit about to be inspected being informed. An N.C.O. about to carry out this duty should, if the unit to be inspected is in possession of an R.A.M.C. officer, report to him. If otherwise he must proceed to the unit's orderly room and obtain the permission of the O.C. or his representative.

The inspecting N.C.O.s should at the time of inspection call attention to any defects in the sanitation, and give advice as to how they can be

remedied. A report on the sanitation of all units inspected must be made to the O.C. sanitary section, who, if the report is an unfavourable one, should personally satisfy himself that it is well founded before reporting the unit to the A.D.M.S., who should bring the matter to the notice of the "A" branch of the staff.

(2) Making sanitary conveniences and giving instruction to selected personnel from units in their construction. These sanitary conveniences consist of such articles as latrine seats, incinerators, etc.

(3) Disinfection of billets when necessary.

(4) Sterilization of infected clothing and the lousing of verminous men, and the organization and supervision of such bathing arrangements as it may be possible to establish for the men.

It is obvious that the divisional sanitary section will not be able to carry out many of its functions when the division is on the march, or when it is in action with the enemy in open warfare.

Its duties will, however, be most important when the division is halted for a few days, and most important of all in position warfare.

The sanitary section should, when contact with the enemy is not expected, march in the rear of the division; when contact is probable it should march with the train transport.

(*To be continued.*)

THE PREVENTION OF MALARIA WITH A DIVISION IN THE FIELD.[1]

By Lieutenant-Colonel C. W. HOLDEN, C.M.G., D.S.O.
Royal Army Medical Corps.

My paper is in the nature of a reminiscence. I intend to relate an attempt to diminish the amount of malaria in a division holding front line trenches. The division was the 22nd, the place Macedonia, and the year 1918. The division was holding almost exactly the same ground during the previous year and comparatively few new men had been drafted into it. Owing to the submarine warfare very few men were invalided to England until the spring and summer of 1918. The 22nd Division was holding trenches, more or less continuous, for a distance of five miles running south and west of Lake Doiran, and the divisional area extended back from this to a depth of about eight miles. The area was mostly broken and hilly and contained on a rough computation some 200 miles of hill streams at the commencement of summer, besides swampy patches, seepage areas, springs, wells and the shore of Lake Doiran.

It is not claimed that the anti-malaria measures employed were new or original. But owing to much of our area being under enemy observation and within artillery, rifle and trench mortar range special circumstances arose and had to be met. Most of the measures were initiated by General Headquarters. But divisions were wisely allowed considerable latitude in the application of orders and the importance which they gave to the different methods to suit their own varying circumstances.

We divided our anti-malaria measures into two groups; the officer commanding units being responsible for the first group and the divisional anti-malaria organization for the second.

In the first group were placed such measures as the protection of men by mosquito nets, seeing that there were sufficient, that they were correctly pitched and repaired; maintaining the health of the troops by good hygiene, etc.

In the second group was included all anti-mosquito and anti-larva work.

These two groups are of very different importance in different localities and under different circumstances. The 22nd Division was stationary during the spring, summer and early autumn of 1918, and held an area which contained no insuperable obstacles to anti-larva work. Therefore our two groups were of equal importance. In another part of Macedonia where divisions were holding fronts of fifteen or twenty miles, with depths to correspond, and where these areas largely consisted of swamps, personal protective measures had to be relied on far more than anti-larval work. And of course when a division is on the march, or even moved frequently, anti-larva work cannot be done at all.

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[1] Read at the Scarborough Congress of the Royal Institute of Public Health, 1923.

By the orders issued from our Corps Headquarters the officer commanding a unit was to be held responsible for *all* anti-malaria measures in and within a quarter of a mile of his camp. The General Officer Commanding the 22nd Division made a very important alteration in this order when he made the officer commanding a unit responsible only for personal anti-malaria measures. These measures can only be carried out through the organization of each unit, and depending on discipline can only be enforced through the officers and non-commissioned officers of the units.

But anti-mosquito and anti-larva measures require special knowledge and skilled labour and it is unfair to expect the officer commanding a unit to be responsible for such work. Nor can one expect that the officer commanding's technical adviser, the unit medical officer, will always possess the knowledge of anti-larva methods which is necessary. There are other reasons also, such as the frequent moves of units and the difficulty of fixing and marking the exact boundaries of camps. Therefore I think anti-larva measures always require a special organization and should not be left to units to do. Officers commanding units were only too pleased to escape this work and to allow the officers and men of the special organization to enter and work through their camps. A divisional order was published authorizing this.

I shall do little more than enumerate the anti-malaria measures which I have grouped as personal. They were:—

(1) The use of bivouac, hospital pattern and bell tent mosquito nets.

(2) Mosquito-proof dug-outs and huts.

(3) Head-nets, gloves and turn-down shorts.

(4) Mosquito repellant substances such as ointments and oils.

(5) General hygienic measures such as attention to cooking, gardening by the troops to provide fresh vegetables, amusements (we had a perfectly wonderful theatrical company and theatre).

(6) Protection from the sun. Reeds were cut from Lake Ardzan, thatching classes were instituted, and corrugated iron dug-outs and huts were thatched and open-air dining shelters made. The difference which this made to men living under corrugated iron roofs in the sub-tropics can be imagined.

To bring home to officers in charge of troops their personal responsibility for the anti-malaria measures which I have enumerated a system of certificates was instituted. A divisional order was published that every officer in charge of a camp was to render the certificate every Saturday between May 1 and September 30, to the commanding officer of an infantry battalion, artillery brigade or similar formation. These certificates were to be kept there for reference till further orders. This order was really made necessary by the number of different camps, often some miles apart and in charge of junior officers, occupied by one unit. Copies of the certificate were sent out from Divisional Headquarters in sufficient numbers, and they began by pointing out that the certificate was valuable in:—

(1) Furnishing in convenient form a reminder of the precautions which must be taken.

(2) In ensuring that these precautions were in fact taken.

(3) In determining the responsibility for taking the precautions.

(4) In ensuring that battalion and equivalent commanders are made acquainted with deficiencies in such precautions in their units.

We felt it was very necessary to point out clearly the reason for adding to the clerical work of harassed combatant officers in the field.

The certificate ran:—

"I certify that daily during the week ending . . . at the camp of . . . situated at . . .

(1) All bivouac and hospital pattern mosquito nets were inspected each morning. They were correctly pitched. All needing repair were repaired.

(2) All mosquito veils and gloves were inspected daily, and all needing repair were repaired.

(3) A sufficient quantity of mosquito repellant was available throughout the week.

The above inspections were all made by me personally except on . . . when they were made by . . .

Signed . . . ."

So we hoped to ensure that these important duties were not permanently delegated to non-commissioned officers.

With regard to the use of quinine prophylactically during the malaria season of 1917, General Headquarters ordered the whole Force to take ten grains of quinine twice weekly. Early in 1918 the Director of Medical Services called a conference of all D.D.'sM.S. and all A.D.'sM.S. to reconsider the subject. He asked each in turn "Did you yourself take quinine prophylactically last year?" Being truthful men all answered "No, sir." The Director of Medical Services said "Neither did I, and if none of us thought it worth taking quinine ourselves last year, we cannot recommend the Commander-in-Chief to order everyone else to take it this year." So the prophylactic administration of quinine was not ordered by General Headquarters during the year 1918, and the annual report on malaria for that year notes that "the results of departure from tradition are remarkable by their absence."

Another incident. During January and February, 1918, the two divisions and the corps troops comprising twelve corps took thirty grains of quinine daily per man for twenty-two consecutive days. Every effort was made to ensure correct administration. As a result in the 22nd Division the admission to field ambulances for malaria decreased considerably during its administration and for about a week after. Then admissions gradually rose again till they equalled the numbers before the administration began.

In fact the British Salonika Force ate quinine, drank quinine, took it as enemas, as intramuscular injections, as intravenous injections and in spite of all one wit remarked that the British Salonika Force might be divided into two parts—the sick and those who looked after them.

I will now pass on to anti-mosquito and anti-larva measures. The division being stationary and on favourable ground these were looked on as of the very greatest importance. The usual measures were undertaken, viz.: Killing adult mosquitoes with fly killers, by fumigation with sulphur, and by spraying with Lefroy's or other fluid; cutting brushwood, bush and reeds along the banks of streams and pools, and over swamps and seepage areas; canalizing streams, filling in and draining pools, draining swamps and seepage patches; filling in, draining or covering wells, covering water-tanks, emptying water receptacles periodically and the use of larvicides such as kerosene and cresol.

From time to time throughout the winter in Macedonia a few larvæ may be found in sheltered pools in warm valleys. But they first appear in any numbers about the end of March.

So in February, 1918, the divisional area was divided into three, and a medical officer was placed in charge of each. These officers were told to survey their areas, see what work needed doing, and how they would employ the labour they might expect later on.

Early in March the divisional anti-malaria organization was ready to work. It was made up as follows:—

(1) The three medical officers already mentioned.

(2) Two anti-malaria squads.

(3) Seven men and one corporal from each battalion and the same from each field ambulance. The anti-malaria squads were organized and trained at the base by General Headquarters before being sent to us. Each squad consisted of twenty-three labourers, mostly Maltese, and three Royal Army Medical Corps men to direct them.

They were sent up to us equipped with tools—axes, picks, bass brooms, watering cans, crowbars, sledge hammers, billhooks, hedging knives, rakes, saws, scythes, sickles, shovels, wheelbarrows, hedging gloves, etc.

The eight men from each battalion were detailed by order of the General Officer Commanding 22nd Division, and were placed absolutely at the disposal of the Assistant Director of Medical Services. When their battalions moved within the divisional area these men did not move with it. A man could not be moved or replaced except by order of the General Officer Commanding. These men were, therefore, permanently on anti-larva work, a point of the very greatest importance. Casual labour can do more harm than good if put on the more skilled part of such work.

The two anti-malaria squads and the men from battalions gave us about 150 all told. These were divided amongst the three areas. But it was not imagined that 150 men could get an area measuring five miles by eight into going order. One calculated there were 200 miles of streams alone, besides swampy patches, seepage areas, springs, etc.

To get the whole thing into going order the General Officer Commanding the division issued orders for a "mosquito week." During this week all work was stopped except manning the trenches, and every available officer and man in the division was turned on to anti-larva work, directed by the

three anti-malaria medical officers, the Commanding Royal Engineer, and the three field companies of the division. Many hundreds of hedging knives, billhooks, axes, shovels, etc., had been obtained. An immense amount of scrub and brush along streams and over swampy areas was cut, pools were filled in or drained, and the work went forward with an enthusiasm engendered, perhaps, by the novelty of the work and the change from dull routine. As so much of the ground was under enemy observation and enemy fire, a lot had to be done at night.

To complete the work the whole of the pioneer battalion was employed upon it for a further three weeks.

Thus from about the beginning of April only maintenance work was necessary for the rest of the season, and this was done by the 150 men of the divisional anti-malaria organization.

In anti-larva work the use of cresol does not appear to be as general as its merits deserve. This larvicide was brought to our notice in a circular sent to us from General Headquarters detailing some experiments performed in the 25th Mobile Hygiene Laboratory by Major Mayne, R.A.M.C. I have not time to give a detailed account of these experiments, but Major Mayne's conclusions were as follows:—

One ounce of cresol in one cubic foot of water (= 1 in 1,000) killed larvæ within two minutes.

One ounce of cresol in ten cubic feet of water (= 1 in 10,000) killed larvæ within fifteen minutes.

One ounce of cresol in 100 cubic feet of water (= 1 in 100,000) killed larvæ within one hour.

One ounce of cresol in 1,000 cubic feet of water (= 1 in 1,000,000) killed larvæ within four hours.

One ounce of cresol in 10,000 cubic feet of water (= 1 in 10,000,000) killed larvæ within twelve hours.

But what was even more interesting was the effect of cresol on egg rafts. One ounce of cresol in 100,000 cubic feet of water (= 1 in 100,000,000) will kill minute larvæ almost immediately they leave the egg. One ounce of cresol in 1,000,000 cubic feet of water will kill them in twenty-four hours. In these dilutions the female mosquito is not prevented laying her eggs on the surface of water so treated, and all water thus treated becomes a trap.

She will not lay her eggs on water treated with paraffin.

Cresol in these enormous dilutions is harmless to man or beast. In dilutions of 1 in 10,000 it cannot be tasted.

Incidentally Major Mayne proved that paraffin oil does not kill larvæ by drowning them, but by poisoning them. Paraffin is much more toxic to larvæ if well mixed with water than if it is merely sprayed on the surface.

It is necessary to emulsify cresol before adding it to a pool, or else it sinks to the bottom. If emulsified it diffuses well.

We had not found paraffin oil satisfactory. Wind will blow it to one side of a pool and larvæ will be found at the other. It is bulky. All weeds

and reeds must be thoroughly cleared. And it burns well in lamps and primus stoves!

We therefore tried cresol and found it ideal. If well stirred in it diffuses readily, and reeds and algæ need not be cleared unless very dense. We found pools would remain free from larvæ for about fourteen days, and we therefore sent our men round once a week to add one ounce of cresol to each 100 cubic feet of water, that is 1 in 100,000. The men detailed readily learned how to make a sufficiently accurate calculation of the number of cubic feet of water in a pool. In addition swampy patches and seepage areas were watered with a dilute solution of cresol.

I need not elaborate the immense advantage of this method to a division in the field. Cresol is a normal Army supply. So little is necessary that transport is negligible. Water so treated is not rendered unfit even to drink. Water so treated becomes an egg trap. Labour is saved in clearing pools of weeds and algæ.

There was one notoriously malarious part of our area to which we had been unable to apply any anti-larva method before cresol was brought to our notice—where our trenches ran down to the edge of Lake Doiran. The previous year every battalion which went into these trenches had a very severe outbreak of malaria soon afterwards. So bad was it that a court of inquiry had been held in 1917 to inquire into the cause of these outbreaks.

A metalled road here ran close to the edge of the lake, and the ground between it and the lake had been used as a borrow pit to raise the road above the lake waters. This borrow pit began where our front line met the lake, and ran back into our area for some eight or nine hundred yards. It varied from a few yards to fifty or sixty yards wide, and in parts averaged a depth of two feet. Other parts only contained a few holes full of water. A bank of gravel separated it from the lake along practically its whole extent. Except for a grove of fig trees in one part, in winter the whole swamp was bare, but in summer it became covered by reeds.

Almost all this swamp was visible to the enemy; all of it could be covered by his rifle fire, and some of it by his trench mortars.

This swamp could not under active service conditions be filled in, and it could not be oiled because of its extent and the growth of reeds.

We determined to cresolize it.

By a rough calculation the swamp held some six hundred thousand cubic feet of water. Eight gallons of cresol in this would give a dilution somewhere about one in fifty thousand.

So one night when it was thought there would be sufficient light for our purpose and not enough to render us visible to the enemy, twenty men were taken down to this swamp and formed up in line at its western end. Each man had a two-gallon petrol tin containing a pint and a half of cresol made up to two gallons with water and well mixed. Also he had an empty jam tin.

The line of men was told to walk straight ahead through the swamp keeping line and distance from each other as well as possible, and to scatter

the cresol freely in front of them with the jam tin. The tops of the petrol tins had been removed so as to allow the men to use the jam tins as dippers. When the tins were empty a halt was called and the men came ashore and replenished them. Then they returned to as nearly as possible where they had left off and proceeded as before.

By throwing the cresol well ahead of them it was hoped that the men walking through the water would assist in the diffusion of the cresol. Any movement of the water was from west to east, therefore we commenced at the west end.

This process was repeated every fourteen days as nearly as circumstances would permit.

On the lake shore itself we never found any larvæ.

I can give you no statistics which would be of the slightest value of the effect of our work in diminishing the incidence of malaria. A comparison would show that the incidence of malaria was greater during the winter of 1917-1918 than during the previous winter. It would show that the incidence during the malaria season of 1918 was considerably lower than that for the season before. But I cannot prove that the large decrease was caused by our anti-malaria work. So many other factors enter into the problem. For instance, during 1917 very few men were invalided out of the country; during 1918 some 20,000 men with malaria were invalided to England. These were men who spent all their time going to hospital and being discharged, thus sending up the admission rate for malaria. Then again seasons vary greatly in malariousness. The nature of the work of the troops, marching and operations, all affect the admissions to hospital in malaria-soaked units. But one can say that mosquitoes were very noticeably fewer throughout the 22nd Divisional area during 1918, that in streams in which were almost pure cultures of anopheles larvæ in 1917 they were difficult to find in 1918, and that after cresolizing the swamp by Lake Doiran I searched there repeatedly without finding larvæ.

There is one anti-malaria measure which I have left to the last by way of emphasizing it. Before entering on anti-malaria work with a division one must choose an enlightened and sympathetic divisional commander. In the account I have given you will have noticed how important a man he is. A division in the front line never has enough men to perform its many duties. It therefore requires considerable courage and faith in the results he is going to achieve for a divisional commander to employ his whole available labour for a week, his pioneer battalion for a month and eight men per battalion for many months on anti-malaria work. Also increasing the clerical work of units by the certificates I have mentioned is not popular. But Major-General Duncan, C.B., C.M.G., Commanding the 22nd Division, made his influence very strong indeed.

There is no doubt, therefore, that when a division is stationary, results can be achieved by anti-mosquito and anti-larva measures right up to and even in front of the front line trenches which will be well worth the time, labour and material expended upon them.

THE TRAINING OF R.A.M.C. OFFICERS FOR WAR.

By Major M. B. H. RITCHIE, D.S.O.
Royal Army Medical Corps.

I.

Among the official books issued recently is one termed "Courses of Instruction, 1923-24." It explains the objects, organization, scope and programmes of courses at the various Army schools of instruction, and draws attention to the underlying principles which determine the nature of schools of instruction as a whole, and to the functions which these schools are intended to fulfil. Then follow the details of the various schools, which are twenty-five in number and include the senior officers' school, small arms, physical training, education, machine gun, equitation, military engineering and military administration, besides several others of equal importance.

Eight pages are devoted to the R.A.M.C. Training Establishment and the Army School of Hygiene. The former has courses of instruction for newly-joined officers of the R.A.M.C., I.M.S., Army Dental Corps, R.A.F. Medical Service, R.A.M.C. Militia, and the Territorial Army. At the Army School of Hygiene there are courses of instruction for officers, N.C.O.'s and men of all arms; for newly-joined officers of the Medical Services, R.A.M.C.; for sanitary orderlies, and for the higher training of such orderlies as are selected as suitable for sanitary supervisors, instructors and sanitary inspectors. Personnel of the Royal Marines, R.A.F., and the Territorial Army also receive instruction at the School.

In another part of the book there is a description of the School of Military Administration, where three officers of the R.A.M.C. attend the senior officers' course held at this School annually. This appears to be all that affects the R.A.M.C.

This book is interesting to peruse as it demonstrates the advances made in training and educational arrangements in the Army since the War. It demonstrates also the care which is taken to provide sound uniform teaching, and the dissemination of this teaching throughout the Army. Yet to the R.A.M.C. officer the book provides food for reflection.

II.

The great majority of the individuals who compose the Army, officers and men, join raw and are trained in and by the Army. During their service they receive additional instruction in new subjects and attend refresher courses in subjects which they have already studied. To them the Army is a big training school in which they have learnt all that they know of their profession.

The Royal Army Medical Corps officer, in contrast to this majority and in contrast to his own warrant officers, non-commissioned officers and men, joins the Army as a qualified man, presumed to be already trained, who requires but a smattering of drill, interior economy, and familiarity with military conditions to fit him for his duties. The need for instruction in the military medical side of his profession is but tardily recognized outside his own Corps. Cavalry, infantry and artillery, for example, are organized in peace as they are in war; their constant daily training is devoted to the duties required of them in war, and they have no definite *rôle* to play in peace. In short, they exist for war. But the Army Medical Services of peace and the Army Medical Services of war are two separate entities, differing widely from each other in organization, equipment and scope. The war Medical Services spring into being only on mobilization, created from a nucleus peace Medical Service which has been carrying out onerous duties in treating the sick, which has had little opportunity of studying the changed responsibilities that have to be assumed on the outbreak of war.

In view of the tendency to regard the Army as a large training establishment designed to train its personnel for war, it is curious to observe how few facilities exist for the instruction of R.A.M.C. officers in the theory and the practice of war medical administration. And war subjects, unlike professional subjects such as medicine and surgery, cannot be studied outside the Army at civil educational institutions.

III.

The need for a refresher course in professional subjects is recognized and the R.A.M.C. captain goes through an excellent professional course of study at Millbank. In this respect he is fortunate, for he obtains gratis instruction such as his civilian confrère cannot obtain without considerable expenditure of money. Beyond this, the R.A.M.C. officer receives no further instruction during his service unless he happens to be one of the fortunate trio selected annually for the Senior Officers' Course at the School of Military Administration. (The inclusion of R.A.M.C. officers among those eligible to attend this course is a very distinct forward step.) Otherwise, the R.A.M.C. officer is barred from training establishments. There is no Senior Officers' School for him, no Staff College, and no refresher course of any description even in professional subjects.

He may attend the Captains' Course at Millbank with five or six years' service, before he is 30: though he serves on to the age of 60 and completes thirty years' service or more, the Army will teach him nothing, but will examine him periodically for promotion in subjects which he has to learn up for himself. Many of these subjects have a distinct war value, though others have not. Examination questions on peace time routine duties or on the Geneva Convention, answered from pre-war training manuals and regulations published in 1906 and 1911, cannot be termed progressive.

The wide subject of gas warfare has to be given an equally wide berth, due to the absence at present of a literature on the subject. Questions in hygiene examinations, however, represent situations with which the administrative medical officer of the future will have to deal, and in this respect hygiene appears to score a progressive victory over other subjects.

Let us refer briefly to the facilities which exist for the instruction of the Other Ranks of the R.A.M.C. After leaving the depot, N.C.O.'s and men receive instruction in technical duties at the hospitals where they are serving. The examination papers in the various subjects are set at the depot, and there is a definite pass-standard for all stations, whether at home or abroad. The standard of training is high and the instruction is good. The R.A.M.C. soldier, if he wishes to gain promotion to warrant rank, must read hard and pass many examinations. He appears to be well provided with general educational and Corps training facilities wherever he may be stationed in times of peace. What he is not trained in is field ambulance work, but this no doubt will be rectified in the near future when Camps of Instruction are recommenced. The impression of the writer is that the R.A.M.C. soldier of 1923 is as well educated and trained, and as efficient for war, as were our Glorious Contemptibles when they set out on the great adventure in August, 1914.

IV.

In pre-War days the instruction in field medical duties was obtained at Medical manœuvres, R.A.M.C. Camps of Instruction, Medical Staff tours and General Staff tours. Medical manœuvres and Camps of Instruction provided a useful war training for personnel likely to be employed with field medical units in war. The exercises usually demonstrated the working of the medical services of an infantry division, together with the details of field ambulance organization and equipment; every medical officer, whatever his rank, should be conversant with these matters. Staff tours dealt with the divisional medical organization, the problems connected with evacuation of casualties to a pre-supposed base, and the medical services of corps and armies (in the pre-War conception of these formations). It is more than probable that these or similar field exercises will be resumed in the near future, when financial conditions permit, but while recognizing their value and utility we must also realize their limitations. For such exercises do not cover the whole ground of instruction. They are limited to the duties in action of the medical units of a division and to the administrative duties of A.D.'sM.S. or D.D.'sM.S. of formations, while these formations are engaged in definite military operations. This is part only (and indeed a very small part) of the medical administrative problems which have to be solved in war, and it is the part which is most cut and dried.

There are numerous other matters of importance which have to be dealt with by the Medical Services in war. To define a few of them at

random one would mention the formation and organization of large hospital centres or bases, the fitting out of the medical services of expeditionary forces for service overseas, the application of new medical and surgical discoveries to military medicine, the provision of new equipment and stores, the higher administrative duties in war, the higher organization and policy, the mobilization of the profession for war, the consideration of new means of transport, the methods of dealing with new types of casualties, and war hospital construction. Such problems the military medical officer will have to study if he is to fit himself for his duties in future wars.

V.

As regards the two branches of R.A.M.C. duties, the professional and administrative, the tendency at the present day is necessarily towards the professional, as it is the only branch open for study. Before the war the pendulum swung the other way, as the necessity for senior officers studying administration was then established by those clear thinkers to whom we owe so much. They foresaw the War, and foresaw that the regular officers' duties in the War must be administrative more than professional, as the influx of the civil profession on mobilization would ensure an adequate supply of specialists and well-qualified men. In many ways it was this study of administration which gained the Corps its success in the War, though the high professional standard was responsible also. The professional side is to the administrative side what the Navy was to the Army in the War. The Navy ensured the command of the sea and enabled the Army to be dispatched to France and maintained there. Without this command of the sea the whole Allied cause might have been lost; it was an essential factor which enabled the war on land to be fought to a successful conclusion. Both branches of our duties are essential, but the professional branch comes first. Professional knowledge is the foundation on which administration is built, and must therefore take precedence. The status of the Corps, as judged by the civil profession and by the rest of the Army, depends on the professional attainments of its officers. The clever medical officer, once his ability is generally recognized, is in a very independent position. Even cardinal military sins, should they appear, are readily condoned in the presence of professional genius. In brief, it is by our professional merits that we stand or fall.

During the five years which have elapsed since the end of the War R.A.M.C. officers have not been idle. They have been studying their profession, and the number of degrees and diplomas obtained is larger relatively than before the War. The presence in the Corps of officers with qualifications such as F.R.C.S. and M.R.C.P. raises our status considerably. It is for the benefit of the service in general and for the benefit of the sick soldier in particular that officers should improve their professional knowledge, even though many may retire early into civil

life where high qualifications are possibly of more immediate value. Nevertheless, the importance of administrative study is not to be overlooked because in another war the R.A.M.C. will have to be expanded enormously, as it was in 1914. Skilled physicians and surgeons can be had in plenty in a national emergency; patriotism will see to this. What the Army will not be able to obtain, what money cannot buy is the skilled medical administrator, for he does not grow outside. Therefore, the Army must eventually begin to create him in sufficient numbers by special training in the subject. Whatever the qualifications of an R.A.M.C. officer may be he will have to become a specialist in medical administration also. And it is from the well-read and well-qualified that the best type of administrator can be developed.

The civil profession and the general public still consider that the services of highly qualified medical men are wasted when they are employed on administrative duties. At first sight this view appears to be quite reasonable but it does not bear analysis. It reveals a disposition to leave the direction of medical affairs in the hands of less able medical men, or of lay administrators, to place the highly qualified individual in the position of a technical adviser who, while able to give valuable advice on his own subject, is not considered capable of taking part in the general direction of medical affairs. Occasionally, the highly qualified may affect to ignore administration, or the less highly qualified to ignore professional work. But while the latter attitude is merely comic the former is serious. The doctrine of "too proud to administer" is reactionary and unprogressive, as the civil profession will probably discover. In the Services and in the civil profession it is the men with the best qualifications and the best brains who are required for administration. If the profession and the Services are to move forward from their present "advisory" positions the highly qualified men turned administrators will lead the forward movement.

VI.

An important feature of Army training is the cultivation of *moral*. Much attention is paid to this for it is a quality with a high efficiency value in war. *Moral* is difficult to define but may be described as "guts" and plenty of it. And "guts" not only wins battles; it creates efficiency in all branches of life, civil or military. The cultivation of "guts" is as necessary for the R.A.M.C. as for other branches of the Service—for the senior officer as for the recruit. He who is attending courses of instruction, who is studying and striving to master his subject, acquires this essential quality. He who is not using his brain, who neither reads nor attempts to improve his knowledge, who is not "keen," may fail to acquire it. We hear a great deal about post-War unrest, and most of us have bitter experience of it. Mentally, there is another condition which requires to be combated, and that is *post-War rest*. For the tendency of peace soldiering after a long war is to "slack." Pardonable in the first few years of peace,

it must not continue as a cherished institution, for collective mental stagnation in any body of men leads directly towards collective inefficiency.

Qualitative deterioration is another condition which has to be combated in a reduced *post-bellum*[1] voluntary army, when soldiering in any arm becomes *démodé* among the youth of a nation, when the best brains among the young men are diverted into commercial and scientific channels, and when motives of economy and the absence of any immediate necessity for maintaining a large army result in the retirement of the abler officers to seek for scope in civil life.

In the cultivation of *moral* lies the prevention of stagnation and deterioration, and *moral* is cultivated by instruction. Foster instruction, and mental stagnation ceases. Once efficiency and keenness are developed little difficulty is experienced in finding the right types of recruits. A body of men which is mentally active will not lack them. High ideals and objectives are necessary, but they must be progressive and not reactionary. And in this connexion it is doubtful whether the present universal tendency towards the 1914 standard is wholly sound, though it is sound in part. It aims at re-establishing the high index of efficiency which existed throughout the British Army in that eventful year of world history. Herein it is perfectly sound. But there are numerous arguments against the application of the 1914 standard to future requirements. As regards its application to the Medical Services in future campaigns there is but limited value to be obtained from it. Though many 1914 principles of medical organization in war may affect medical policy for many years to come, the new organization of the Medical Services will have to be built up more from what is likely to occur in future warfare than from what has occurred in the past.

VII.

We are apt to leave war medical questions in the hands of R.A.M.C. officers serving at the War Office. They are in touch with those who frame policy and whose duty it is to remodel and improve the military machine, and they are thus better informed and better placed for dealing with war problems than officers serving elsewhere. Yet the War Office staff is small in number, and much of its time is taken up with routine duties. Hours of work are long, and general surroundings permit of little spare time for reflection. Officers serving at the War Office are specially selected for their ability and experience, and any matters with which they deal are placed in very capable hands. Even so, it does not appear to be quite fair to these officers to leave medical war problems entirely to them. For war problems concern us all and require to be studied by everyone in the Corps. *New conceptions and fresh ideas should emanate from the periphery more than from the centre.* It is the officer

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[1] An ugly-sounding word—offspring, perhaps, of a classical mind led astray in the dark corridors of the War Office. Yet it has no English substitute.—M.B.H.R.

serving at out-stations or abroad who should have the ideas; it is for him to supply them and for the War Office to co-ordinate and assess our varied experiences and opinions and to pick out what are best. Questions of medical organization in future wars must be studied by the Corps as a whole, threshed out and criticized frankly, so that every proposed innovation can be examined from all points of view. Free, unfettered discussion can assist our leaders materially.

The first volume of the "Medical History of the War" contains an illustration of the need for general discussion of war problems. In the original establishments of the Expeditionary Force no motor ambulances were included. Instead, casualties were to be evacuated in supply and other vehicles on the return journey to railhead. Though we all knew that returning empty supply lorries and wagons were neither suitable nor sufficient for the evacuation of casualties, we did not then realize that our leaders knew this as well as we did and were striving their utmost to have motor ambulances sanctioned. Had we studied the organization collectively, had we discussed and represented it, motor ambulances would most probably have been authorized before the War began. A body of officers studying such problems and finding out the weaker points of a proposed organization must carry considerable weight, and with the opinions of the whole Corps behind them, our leaders could have represented more effectively the need for motor ambulance transport. The defects they saw but could not rectify would have been rectified if we had applied ourselves to a closer study of our own organization for war.

VIII.

We must begin now to think of our future war responsibilities. We must not be content to accept unhesitatingly the medical arrangements and organization in past wars, though we must admit that they were born of wide experience and respect them accordingly. We must realize that we have to keep up the study of our duties in war and that these duties form a branch of study quite distinct from our duties in peace. The scope of the R.A.M.C. in peace is the medical and sanitary care of two hundred odd thousand young fit men and the families of the married personnel—very different indeed from its scope in war. Part of the war organization of the Medical Services is already in the melting pot; the rest of it may have to be thrown in later on. From now onwards new conceptions of warfare will begin to crystallize and the crystallization must be observed closely by the R.A.M.C. Even the deliberations and findings of committees which considered the medical organization of the late war may be of limited value. *In a few years from now we may be as far removed from the principles and methods of the late war as we were from those of the Crimea when we mobilized in* 1914.

Another matter requires our attention. In other branches of the Army military education is forging ahead. Large numbers of officers have

passed through the Staff College and the standard of military efficiency has risen considerably. The good officer of field rank possesses ability as well as application, and is striving to master the higher branches of military science in order to fit himself for the duties he will have to perform in war. If we do not begin to study our own higher organization we shall find ourselves at a disadvantage, for staff officers may be as conversant with medical war organization as we ourselves are. And there is the risk also of finding ourselves placed at a mental disadvantage. For an officer who has graduated at the Staff College, who has held higher staff appointments and has had good facilities for military study at several schools of instruction, and who in addition is endowed with ability and inspired by keenness, may mentally outclass a comrade of greater ability who has had no facilities for study nor had his imagination developed. To obtain a medical degree is in itself an index of ability; if ability appears to be lacking in later life—if the individual has not "clicked"—the inference is that keenness has not been fostered nor inspiration received. Inspiration can be found in professional subjects, but not to any extent in dull peace-time routine administration. Where it lies in abundance is in the preparation of the Medical Services for future warfare.

X.

At the present moment then, the Army is being educated and instructed continually but little of this education or instruction comes our way. We have an excellent professional "refresher" course at Millbank, and we are very grateful for it. We cannot at present expect a senior officers' course in medical administration for the very simple reason that courses cost the taxpayer money, and the taxpayer does not seem inclined to spend one penny more on the Medical Services of the Army than he can help. But though schools of instruction cost money, schools of thought cost nothing. We can begin to study the subject ourselves, and we have a journal to record our views; we can begin to study our future war organization, personnel, equipment and transport, and how these can be developed. The tactical employment of medical units, their adaptation to meet new military conditions and new medical responsibilities, the exclusion of non-essentials, and the inclusion of the tank, the aeroplane and even the motor lorry in the Medical Services—these are a few of the problems which will require our careful collective study in order that sufficient data may be obtained for committees or individual officers who have to decide eventually what our policy is to comprise. Recommendations made by such committees or individuals are likely to receive more attention if they are supported by the considered opinions of officers throughout the Corps.

There is no "general staff" for the Army Medical Services—that is, no branch of the Director-General's staff dealing solely with war problems, operations and training, on lines similar to the general staff of an army. The question arises whether we cannot do some of this general staff work

ourselves if we cultivate the divine gift of imagination and apply it to our future responsibilities. The advantages accruing to the Army in general from this development may establish the necessity for special administrative training and for the opening-up of other Army schools of instruction to our officers in order that our sphere of usefulness may be enlarged. As regards courses of instruction, though it is expensive to relieve officers from duty and maintain them at definite schools for definite periods, yet it is comparatively inexpensive to send instructors to hold classes at the larger stations where officers can attend while performing ordinary duties. It may be that the existing training and teaching institutions of the R.A.M.C. at Millbank and Aldershot will expand to cater for larger numbers of officers, to hold short courses of instruction in both administrative and professional subjects, or to form a "Mobile Teaching Unit." And the Army is not so conservative as to ignore the value of present-day methods of teaching, such as the evening class and the correspondence class. Perhaps these may help to meet the case. *The medical man, if he is to keep abreast of his profession, must be a student all his life; in addition, the medical man in the Army, if he is to keep abreast of his duties in war, must study administration all his service.*

REPORT ON A CASE OF SARCOSPORIDIOSIS IN A HUMAN HEART.

By Major J. A. MANIFOLD, D.S.O.
Royal Army Medical Corps.

The infection of human beings by protozoa of the genus *Sarcocystis* is sufficiently rare to warrant the recording of another case.

Although a common infection of domestic animals, the actual number of recorded authenticated cases in man appears to be limited to three, all reported in individuals outside Great Britain.

Darling [4] states that "Sarcosporidiosis in man has been seldom reported. This is because the infection is extraordinarily rare"; Theobald Smith [1] in accounting for the paucity of cases points out that "the muscular system of man is not subjected to that scrutiny which the viscera undergo in pathological inquiries and that sarcosporidia may be present and yet not be recognized." The first case was reported by Kartulis [2] in 1893, who found Sarcosporidia in the liver and muscular system of a Soudanese suffering from multiple liver abscesses. In 1894 Baraban and St. Remy [3] found Sarcosporidia in the laryngeal muscles of a man who had been executed by hanging. Darling [4] in 1909 reported a third case in which he discovered Sarcosporidia in the right and left biceps of a Barbadian negro during life.

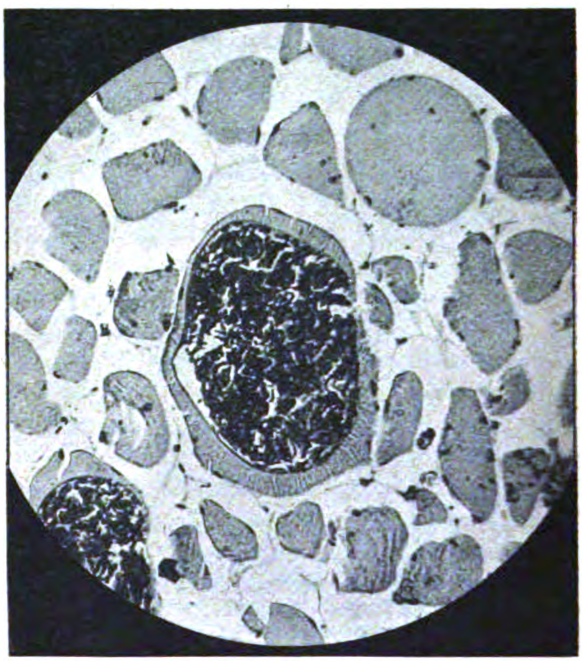
The present cysts were found by the writer in the muscle cells of a human heart in the pathological laboratory of the Royal Army Medical College.

Before describing the actual Sarcosporidia found in this case a brief note concerning the common characters of these protozoa may be of interest. Although of everyday occurrence to those concerned with the morbid histology of animals, or to protozoologists, Sarcocystic infections come little under the notice of medical officers, and may often pass unrecognized. Until recently they have been considered of no pathological importance, but McGowan [6] states that an important disease of sheep, "scrapie," is now considered possibly to be caused by *Sarcocystis tenella*. Sarcocystic infections have been found in domestic animals and reptiles throughout the world, and more than twenty-eight hosts have been described. In Europe a large percentage of sheep and swine are affected—and to a less extent birds, rats, guinea-pigs, etc. Various species are described, varying in details, size, etc., according to the animals in which they occur. Protozoologists are now coming to the opinion that these are probably of one species, modified by the particular host, in which they happen to pass their parasitic existence.

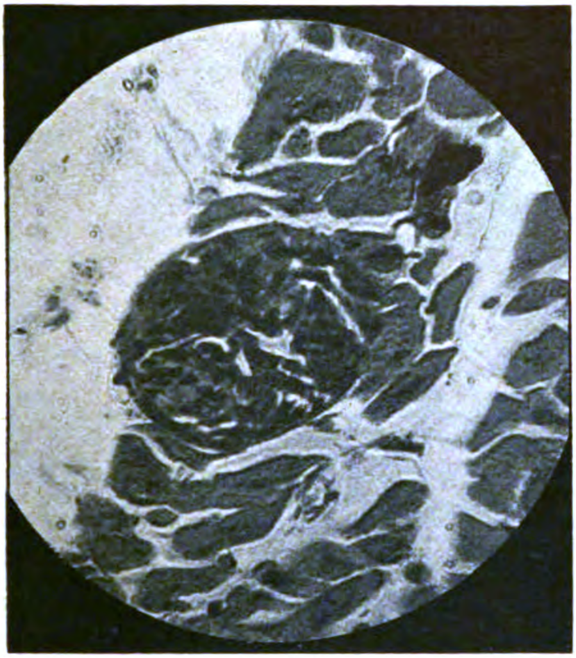
Histological Features.

The Sarcosporidia found in rats, *Sarcocystis muris*, or in sheep, *S. tenella*, are visible to the naked eye as whitish streaks, or oat-shaped bodies. These

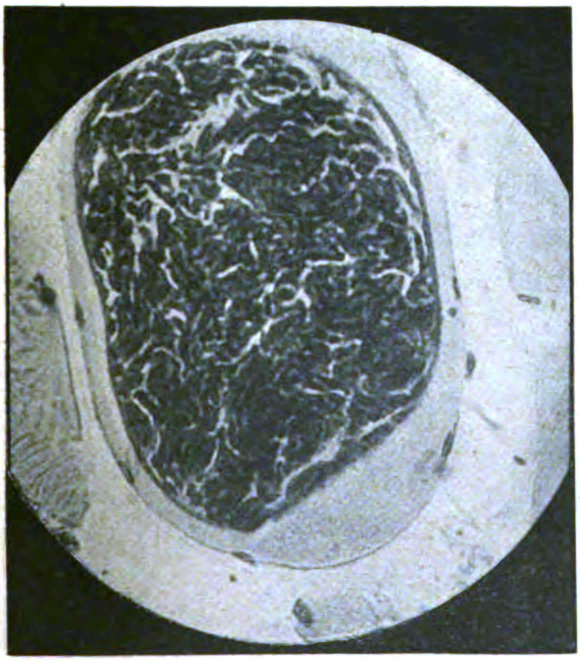
Sarcocystis in human heart. × 246.



Sarcocystis miescheriana. × 246.



Sarcocystis in human heart. × 372.



Sarcocystis miescheriana. × 372.

examined histologically are found to be cyst-like, limited by a thin membrane, and present inside the muscle cell, which forms an outer lining and apparently consists of healthy tissue. The membrane is said by some to be covered with hair-like processes which extend into the muscle substance, and to be pierced by fine pores or cracks. The interior of the cyst is filled with sickle-shaped bodies possibly spores. These bodies have one end more or less pointed, the other blunt. In the latter a nucleus which stains feebly, and with granules of chromatin around it, is present. The pointed end contains an unstained area.

A fine network of trabeculæ is usually present passing from the lining membrane around the cyst; this divides the cyst into small chambers in which the spores lie.

McGowan [6] considers that, when ripe, the spores burst. The granules around the nucleus are discharged into the interior of the cyst, and by amœboid movements pass through the fine cracks in the cyst wall and infect other muscle cells in the vicinity.

Method of Infection.

In omnivorous animals infection can be carried by feeding on one another. This has been proved experimentally by Darling [5] and Theobald Smith [1]. But that this cannot be the only method is certain, as cattle, sheep, etc., are not carnivorous. Theobald Smith suggests that there may be "an intestinal stage, which permits the discharge of spores outwards," or that the muscle parasite must be an "aberrant form from some invertebrate taken in with their food." McGowan [6] has proved that *S. tenella* can be transmitted to the lamb *in utero* from the mother.

Sarcocystis in Human Heart Muscle of Present Case.

Three cysts were found in one portion of tissue and two others in sections from tissue in the vicinity. Numerous other portions have since been examined without success, so the infection must have been slight. These cysts were all microscopic in size. The dimensions correspond closely with the dimensions given by Darling, but are even smaller—the length of the spores is a trifle longer than those seen in Darling's case, but owing to the bent form these assume they are difficult to measure accurately.

The thin lining membrane stains well, but no traces of hair-like processes can be seen—the cysts are packed with the usual sickle-shaped spores, which are evenly distributed, and give no indication of being packed into spore chambers, nor can any evidence of a reticulum be made out. The surrounding muscle appears quite healthy in two of the cysts, but is somewhat hyaline in the third—no signs of inflammatory reaction, cellular infiltration, etc., can be made out.

Darling, in his feeding experiments on animals, found that *S. muris*

became microscopic in size when fed to guinea-pigs. He considered that the form of cyst found in these experimental guinea-pigs was closely allied to the type found in his human case, both being examples of an abortive type. He was unable to find any trace of reticulum inside the cysts in the guinea-pigs, or in his human case.

The cysts in the present case thus tally closely with his description.

Dimensions of cysts and sporozoites, and also those of Darling's case are given below:—

	Cysts in muscle cells of human heart			Cysts in biceps muscle (Darling's case)
	A (mm.)	*B* (mm.)	*C* (mm.)	(mm.)
Sporozoon—				
Length	·057	·045	·034	·084
Width	·045	·039	·026	·027
Spores—				
Length	·01092	·01092	·01092	·00425
Width	·00156	·00156	·00156	·00175

I am indebted to Dr. C. M. Wenyon for confirming the diagnosis of *Sarcocystis*, and to Dr. J. G. Thomson for the preparation demonstrating *Sarcocystis miescheriana* from which the two photomicrographs of this infection are taken.

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COMPARATIVE RESULTS IN THE TREATMENT OF FRAMBŒSIA TROPICA IN NORTHERN NYASALAND.

By Captain W. H. DYE.
Royal Army Medical Corps.

THIS distressing and contagious disease is confined to a limited and definite area and is not common to the whole district.

The district known officially as North Nyasa consists of two distinct types of country. A lake shore level area (1,600 feet above sea level), running the whole length of the district, of varying width, but nowhere more than ten miles wide, and an hinterland composed of mountains, valleys and plateaus of varying height. Some of the plateaus are as high as 4,400 feet, but most of the inhabited land is not more than 2,500 feet above sea level.

The inhabitants of the lake shore level area are a branch of the Wakonde tribe and are banana eaters, and the villages are generally situated in banana groves. The highland people are of various tribes and do not cultivate the banana.

The area in which frambœsia is endemic is along the lake shore and is continuous with the infected area in Tanganyika Territory (late German East Africa), from which it has undoubtedly spread. Solitary cases can be found in other parts, but a history of a visit to the endemic area can always be obtained and is usually volunteered as the cause.

NATIVE NAMES, CUSTOMS, ETC.

Many natives associate the disease vaguely with the banana diet, but more accurate information shows that it was unknown before the advent of the Arab, who came and settled in this part for the collection of slaves and ivory. This also undoubtedly applies to syphilis, and confusion between the two is naturally common.

The local Wakonde name for the typical secondary eruption of yaws is "fiwangala." The word is derived from "viwangala," meaning a bell, and refers to the small, circular, rather flattish bells sometimes hung round the necks of their cattle, in which they see a likeness to the larger granulomatous crust-covered nodules, so characteristic of the disease.

If, however, the patient should have any lesion on the genital area, as is so frequent in women, the term "kaswende" is used for the whole condition.

The word "kaswende," although used locally for any sore on the genital area, has no actual meaning for these people, as it is a foreign word which has been introduced from farther north. Unfortunately the term is loosely translated by the lay European as syphilis, and this has given rise to the impression that venereal disease is much more common among these people than actually is the case. The late lesions, such as gummata, dactylitis and pseudomycetoma, as well as the tertiary lesions of syphilis, are referred to as "mpenga," a word most probably derived from the verb

kupenga, to blow the nose, and signifying the discharge of matter from the body.

The contagiousness of the secondary eruption is well recognized by the natives, although the possibility of fly transmission is not known. They consider one attack immunizes the person for the remainder of his life. The truth of this statement is I think very doubtful.

The local customs are as follows: If a married woman contracts the complaint, she is usually isolated in a small hut, and her children put with her, in order that they may become infected and thus immunized. This naturally leads to a high percentage of cases among the children. The woman may or may not continue to prepare her husband's food, depending usually on the extent of her disease and to a certain extent on whether her husband has had the disease previously. If the husband is attacked, the children remain with him and the wife may or may not be isolated, usually the latter.

Signs and Symptoms.—These have not materially differed from the usual textbook description. It has, however, been noticed that the granulomata of the so-called secondary stage have a marked predilection for moist areas in the early stages. The common places in women being the axillæ, under the breasts, between the labia and in the gluteal fold. In men, the axillæ, between the scrotum and thighs, and the gluteal fold being the common situations to find the early papules. In small children the parts most often attacked are the corners of the mouth and chin, also between the scrotum and thighs in small boys, though rarely the labia in little girls; but when the eruption becomes more advanced and diffuse, any part of the body may be attacked.

In adults a tendency for the papules to be distinctly crescentic in shape has been noticed in a fair proportion of cases, but has never been observed in a child. One case only of pitted palms has been seen in some hundreds of cases. Dactylitis and pseudomycetoma are very common, and cause a great deal of crippling and deformity in neglected cases.

A rise of temperature which would not yield readily to quinine has not been observed, and both adults and children appear to keep in good general health and to have very little if any constitutional disturbance. The duration of the disease if untreated appears to be of considerable length Actual dates are hard to obtain except in the case of a few educated natives. But the secondary stage would appear to last a long while, possibly up to two years or more, the papules disappearing to be replaced by fresh ones. Although the secondary eruption is extremely common in young children and babies for reasons already stated, no definite late or tertiary lesions have been seen in anyone under the age of 15 years. The tertiary lesions are commonest between the years of 25 to 30, with a history of "fiwangala" (secondary yaws) in childhood.

Amongst these primitive people medicine and witchcraft are very closely allied, and it is impossible to obtain any precise information as to the native medicines given for yaws. Apparently they have no successful treatment

for the disease. They have however an unbounded faith in the application of $CuSO_4$ crystals, a mode of treatment introduced by the Arabs.

Treatment.—Because of the high cost of the drugs required to treat this complaint, it appeared of value to work out, over a long series of cases, the comparative results of the various methods of treatment in vogue, and to estimate the relative cost of each method.

I propose in discussion of the various methods to divide the cases for convenience into:—

I.—Secondary yaws, to include all the cases of simple papules and granulomata, which will include all the cases occurring in children.

II.—Tertiary yaws, to include all the cases presenting big ulcerations due to breaking down and fusion of secondary granulomata. All gummata, and cases of dactylitis and pseudomycetoma. This has been done, as it was found that the latter or so-called tertiary lesions were much more resistant to treatment than the earlier lesions.

(A) Arsenobenzol Preparations.

Novarsenobillon and galyl have been the only two preparations of this kind of drug so far available. Owing to the difficulty of doing intravenous injections on young and very timorous children, these drugs have been used on adult cases only.

(a) *Novarsenobillon.*

(1) *Secondary Stage.*—Two injections (0·3 and 0·6 gramme respectively) given at seven days' interval were found to give excellent results. The granulomata disappearing and leaving a hardly perceptible scar, and no recurrences being recorded at the end of twelve months.

(2) *Tertiary Stage.*—The above dosage was found to be insufficient for a complete cure of these cases. It was found that a further injection of 0·6 gramme was necessary and a good and rapid result was then obtained, even in the worst cases, with secondary septic infection. This infection did not appear to make much difference in the rate of healing.

(b) *Galyl.*

(1) *Secondary Stage.*—Three injections of 0·3 gramme, given with four days' intervals between injections, has been found sufficient to clear up the symptoms and prevent recurrence.

(2) *Tertiary Stage.*—These cases were found to be more variable in their reaction to this drug, but an average of six injections of 0·3 gramme each, giving a total of 1·8 gramme, has proved efficacious and no relapse has been recorded to date.

(B) Potassium Iodide.

(1) *Secondary Stage.*

(a) *Children.*—A dosage of twenty grains daily, given as a morning and evening dose of ten grains each for a period of fifteen to twenty-one days has been found most satisfactory. Very occasionally the course has had to be continued a little longer, but this is unusual. The children remain bright and cheerful, and only one recurrence has been recorded.

(*b*) *Adults.*—The maximum dose tolerated has been found more economical than a smaller dose given over a longer period. For this reason I have given three drams a day, in one-dram doses three times daily. Most cases require fifteen days' treatment, the scars are satisfactory, and no return for recurrence has been recorded. I have seen some of these cases six months after and a less number twelve months after, and the general condition of the patients has been excellent.

(2) *Tertiary Stage.*

(*b*) *Adults only.*—These cases appear to require massive doses of potassium iodide over a much longer period, depending to a certain extent upon the length of time the condition has existed. At least thirty days' treatment with the above dosage is required if relapse is to be prevented. The natives tolerate this dosage well, and do not appear to be affected in their general health by its administration over a period of two months, which is the maximum time I have administered it.

(As a point of some interest it will be noticed that young children are more readily cured than adults by this drug.)

(C) Castellani's Mixture.

This was tried in the dosage recommended by Castellani, that is, potassium iodide one dram, tartar emetic one grain, given three times a day. I have not found this any improvement over potassium iodide given alone in the same strength, and the mixture is very apt to cause vomiting and should be increased very gradually.

I do not think it is to be recommended.

(D) Antimonium Tartaratum.

(1) *Second Stage.*

(*a*) *Children.*—Owing to the difficulty of giving intravenous injections to young children who are naturally timorous, the drug has been given by the mouth only. A dosage of a quarter of a grain twice daily was found to be well tolerated by a child of six years and upwards. It is necessary to work up to this dose gradually, in which case there appeared no deleterious effects from its administration.

The results, however, have been most unsatisfactory as regards cure. Some cases showed improvement, only to relapse as soon as the drug was discontinued, while the majority showed very slight if any improvement. I have administered the drug for fifty days, with occasional periods of rest, and the results obtained have been negligible.

(*b*) *Adults.*—On account of the low cost I have now treated a large number of secondary cases with intravenous injections of this drug. A one per cent solution of antimony tartrate to which is added a half per cent of carbolic acid was used. Distilled water not being available, ordinary clear lake water well boiled was used, and found to have no deleterious effects. The tartar emetic and carbolic acid being added to the sterilized water and the mixture not again boiled. Originally the solution was boiled

after adding the tartar emetic, but this was stopped after the following alarming incident. I had been using this method for about a fortnight, when one morning after injecting twelve people, it was reported to me by my native assistant that two of the cases appeared ill. On examination I found these two natives to have a temperature of 101° and 101·5° F. respectively. They looked distressed and complained of severe pain in the lumbar region and severe frontal headache. Their tongues were a vivid red and clean. The pulse was good. Before I had finished examining them it was reported that the remaining ten patients were also ill. They presented similar symptoms. The trouble started about two hours after the injections were done. During the following hour the temperatures went up considerably, some as high as 104° F. In eight of the cases the pulse became very weak, and in two markedly irregular. Pains in the back and frontal regions were severe. I treated their cardiac conditions, and about the end of the third hour after injection all temperatures started to fall rapidly, to be followed by relief from the body pains. By four o'clock, or five hours after injection, they were completely recovered, and of their own accord went down to the lake for their evening bath, which is a sure sign of recovery, for they never willingly bathe if at all unwell. On examining the tartar emetic solution carefully a very slight flocculent precipitate was found, otherwise it appeared normal. This precipitate has never again been found in solutions which have not been boiled after addition of the drug.

The only other reactions noticed when this drug was given intravenously were due to small quantities being put under the skin in difficult cases, such as well covered women with much adipose tissue. On the few occasions that this happened, a tense, painful, hot swelling resulted, and lasted for about twenty-four hours, resolving without any ulceration.

The dosage employed is as follows :—

One per cent solution antimony tartrate—

First day, 2 c.c.	Ninth day, 10 c.c.
Second day, 3 c.c.	Tenth to sixteenth day, rest.
Third day, 4 c.c.	Seventeenth day, 5 c.c.
Fourth day, 5 c.c.	Eighteenth day, 6 c.c.
Fifth day, 6 c.c.	Nineteenth day, 7 c.c.
Sixth day, 7 c.c.	Twentieth day, 8 c.c.
Seventh day, 8 c.c.	Twenty-first day, 9 c.c.
Eighth day, 9 c.c.	Twenty-second day, 10 c.c.

This was sometimes effective, but more often this further additional dosage was found necessary.

Twenty-third to twenty-ninth day, 5 c.c. Thirtieth day, 6 c.c.

Thirty-first day, 7 c.c. Thirty-second day, 8 c.c.

Thirty-third day, 9 c.c. Thirty-fourth day, 10 c.c.

This was usually effective, but certain cases appear very resistant to the drug, and while improving a fresh crop of papules would develop. I have had more cases of recurrence with this drug than with any other, and

look upon it as the least satisfactory. However by repeating treatment at intervals final cure can be obtained if much delayed.

(2) *Tertiary Stage.*

Adults Only.—This drug has proved most unsatisfactory in the treatment of this stage of yaws. As many as three separate courses of injections have been given, commencing with two cubic centimetres and working up to ten cubic centimetres. Giving a week's rest and repeating the course. But although a certain amount of improvement has been sometimes obtained no definite cure has resulted until some other drug has been administered. Very often no alteration whatever was observed. I am inclined to feel that considering the massiveness of the dose necessarily employed, it is hardly worth while pressing it so far, the results in the tertiary stage being so small.

(E) Antimony Tartrate plus Arsenobenzol.

(1) *Secondary Stage.*

Adults Only.—As the antimony tartrate appeared to have a definite if weak action on the causative organism, it was thought that less of the arsenical preparation might be needed if preceded by a course of tartar emetic. This was found to be the case. A daily increasing dose was given as described above, but on the seventeenth day one dose of 0·3 gramme novarsenobenzol was given in place of the second course of tartar emetic. The results were very satisfactory, the granulomata disappearing within a few days and no recurrences have as yet been recorded.

(2) *Tertiary Stage.*

Adults Only.—No gain was found by giving a preparatory course of tartar emetic in these cases.

(F) Antimony Tartrate plus Potassium Iodide.

(1) *Secondary Stage.*

Adults Only.—During a course of antimony tartrate a concomitant daily dose of potassium iodide twenty grains was tried. This gave a more definite and steady healing than with the tartar emetic only, which is peculiarly erratic in its action. A good result was obtained in about our weeks with a very definite saving in the amount of potassium iodide required.

(2) *Tertiary Stage.*

Adults Only.—The same method was tried for the later stages of the disease, but the results were negligible unless the dosage of potassium iodide was increased until it approximated to the dosage required when used alone, and therefore no saving in this more expensive drug was gained.

(G) Arsenobenzol plus Potassium Iodide.

This method was only tried on a very few cases, as the idea of the investigation being to discover the most economical method for general use, such luxurious combinations were of little interest.

The results in the few cases tried were excellent in both stages of the disease.

Conclusions.

The relative costs of each method, with the period of treatment required, will be seen in the following table :—

Method employed	Stage	Average cost	Average time
(*a*) Children.			
Potassium iodide	Secondary ..	1/6	21 days
(*b*) Adults.			
Novarsenobenzol	Secondary ..	9/-	14 days
,, ...	Tertiary ..	15/-	21 ,,
Galyl	Secondary ..	Prices not obtainable	20 ,,
,, ...	Tertiary ..		30 ,,
Potassium iodide	Secondary ..	7/-	15 ,,
,, ,, ...	Tertiary ..	14/-	30 ,,
Antimonium tartaratum	Secondary ..	Negligible	35 ,,
,, ,, ...	Tertiary ..	,,	Not efficient
,, ,, + novarsenobenzol	Secondary ..	3/-	21 days
,, ,, + ,,	Tertiary ..	15/-	31 ,,
,, ,, + potassium iodide	Secondary ..	3/-	28 ,,
,, ,, + ,, ,,	Tertiary ..	14/-	30 ,,

The above values have been worked out on prices ruling at the moment in England (January, 1923). In a distant country like this at least fifty per cent would have to be added for freight charges, etc.

From experience gained in obtaining these results, I am of opinion that treatment with potassium iodide is the only method applicable to young children.

For adults, the ideal treatment would undoubtedly be the combined arsenobenzol and potassium iodide treatment, but with the very large number of cases to be dealt with, this would require an unlimited exchequer. Given the very necessary condition of economy that must always be considered when dealing with endemic areas, I think the combined novarsenobenzol and antimony tartrate method is the most useful for the early stages of the disease. This I am now using as a routine. It is, however, quite useless for the later lesions and there seems little to choose in point of cost between the arsenobenzol preparations and potassium iodide. The former on account of its more rapid action is undoubtedly preferable.

No difficulty has been found in getting these rather primitive people to submit to the repeated injections, although it was quite new to them when I started working up here twenty months ago. They undoubtedly appreciate the rapidity and completeness of the cure, compared with the long periods over which the disease exists when left to itself.

In conclusion I wish to thank Dr. F. E. Whitehead, Principal Medical Officer, Nyasaland Protectorate, for permission to publish this paper.

Clinical and other Notes.

THE DANISH TREATMENT OF SCABIES.[1]

By SVEND LOMHELT, M.D.

Physician for Diseases of the Skin, Royal Marine Hospital, Copenhagen.

During the last ten years a form of scabies treatment with a new ointment has been brought into use in Denmark. It has proved so much of an advance upon all other treatments that it is now almost the only one in use all over this country. One single inunction suffices; after twenty-four hours the scabies is cured, and relapses are never seen. The cutaneous irritation is but slight. The treatment can very well be ambulant. It was first used in 1911 by Professor Ehlers in the hospital of the city of Copenhagen. The ointment was composed by Mr. Marcussen, at that time a chemist of the same hospital. Professor Ehlers made his first publication of the results obtained in 1912 in a Danish medical paper, *Ugeskrift for Laeger*.

Method of Application.

"In my department the application takes place as follows: The patient receives an ordinary cleansing bath, wipes himself thoroughly, and afterwards rubs the whole of his body, except the head, carefully with the ointment, which is almost of the consistency of butter. A nurse or another patient helps him with the back. The ointment must cover all the skin, but hard rubbing is neither required nor desirable. The patient ought then to wait for a quarter of an hour, to give the ointment time to get into the skin; after this he can go to bed. The next day at about the same hour he receives a second bath and fresh underclothing, and the cure is finished. Meantime, all his clothes have been disinfected; I doubt, however, if this is absolutely necessary. All statistics seem to prove that this very simple treatment is as absolutely reliable as it is comfortable for the patient. But as statistics of scabies treatment in a civil population must, for obvious reasons, always remain incomplete in certain particulars, I think it of a special interest to study the results obtained with the treatment in the Danish Marine Hospital, in which hospital all scabies patients from the Danish navy have been treated since April, 1915. A possible relapse would hardly escape attention. In the period from April, 1915, to April, 1920, 678 cases were treated in the said way without a single relapse. Dermatitis was only observed in two patients, treated on the same day by some ill-prepared ointment which caused an alkaline cauterization of the skin. One of these patients stayed seven, the other twenty-one days (see below). The detailed results of this period were as follows:—

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[1] Reprinted by kind permission of the Editor of the *Lancet*.

Year		Number of days in hospital						
		1	2	3	4-6	7	21	Total
1915	..	26	5	2	0	0	0	33
1916	..	67	12	4	1	0	0	84
1917	..	105	28	5	2	0	0	140
1918	..	250	36	2	0	1	1	290
1919	..	93	19	2	1	0	0	115
1920	..	15	0	1	0	0	0	16
Total	..	556	100	16	4	1	1	678

Briefly, a cure carried out in this way is absolutely reliable, rapid, comfortable and cheap—the ointment required for an adult patient costing 3s. or 4s."

Preparation of the Ointment.

"The preparation of the ointment is a little complicated, demanding a certain amount of care and practice to obtain a perfect result. The detailed technique of the preparation (Marcussen) is here given :—

(1) One kilogramme of sublimated sulphur is dissolved at a gentle heat in two kilogrammes of a fifty per cent solution of potassium hydroxide. This makes a clear, yellow solution.

(2) 225 grammes of vaseline and 225 grammes of water-free lanoline are carefully mixed, without heating.

(3) To this mixture 375 grammes of the solution of sulphur in potash-lye mentioned above, is added.

(4) Fresh zinc hydroxide is prepared in mixing 28 grammes $ZnSO_4$ and 40 grammes twenty per cent sodium hydroxide, and this is afterwards added to the ointment.

(5) Liquid paraffin is added to obtain a total weight of 1,000 grammes.

(6) Five grammes of benzaldehyde is added to check the somewhat disagreeable smell of sulphuretted hydrogen.

The high sulphides of potassium are the capital element of the ointment upon which its activity depends, a production of sulphuretted hydrogen taking place when the ointment is placed upon the skin."

Sarcopticide and other Properties of Sulphuretted Hydrogen Gas.

"The sarcopticide power of this gas is very strong. If the hand of a scabies patient is brought into an atmosphere containing 25 per cent of this gas, after half to one hour all the adult mites in the skin are killed. As could be expected, the eggs have considerably more resistance. Unfortunately, the resorption of the gas by the skin takes place rather rapidly; if the whole body, apart from the head, is brought into an atmosphere containing this percentage of sulphuretted hydrogen symptoms of intoxication appear after from ten to twenty minutes, as I have experienced by exposing myself to this treatment, in the hope of finding in this way an absolutely clean and comfortable method of treatment. The

unpleasant odour of the ointment is its only drawback; but this odour is not very persistent, and, moreover, after a few hours decreases to a minimum. Before undergoing the treatment, patients should remove from their persons and from the room all objects of copper, silver, etc., or the latter will be discoloured by the gas. The greatest advantage of the treatment is probably the fact that it is very suitable for ambulatory use. Under these circumstances the patient has to rub himself just before going to bed. In the morning he can wash his hands and carry out his daily work. The next evening he must give his hands a new treatment and take the final bath on the following morning, after thirty-six hours. With reference to disinfection, for most patients a change of underclothing and of bedsheets will suffice, but for poor patients a thorough disinfection must be recommended. At Copenhagen ample arrangements have been made along these lines for ambulatory treatment on a very large scale in out-patient departments, thus avoiding all treatment of scabies within the hospitals. It is quite free to all inhabitants, and is successful in every respect."

REPORT ON THE TREATMENT OF SCABIES BY THE DANISH METHOD.
(CONNAUGHT HOSPITAL, ALDERSHOT.)

Thirty-eight cases have now been treated in this hospital with very good results.

Five of these were readmitted for dermatitis for which they were thirty-one days under treatment. The dermatitis was not of a severe character.

Number treated	38
Number days in hospital	114
Average number of days per case	3
Average number of days under treatment for scabies and dermatitis taken together	3·8

The average number of days per patient for 231 patients treated by liq. calcis sulph. in 1922 was seven days.

The patients treated by the Danish method did not complain of the smell. The preparation can be made up by any careful dispenser.

(Signed) S. BOYLAN SMITH,
Lieutenant-Colonel, R.A.M.C.
O.C. Connaught Hospital.

Aldershot,
December 15, 1923.

REPORT ON THE TREATMENT OF SCABIES BY THE DANISH METHOD.
(ROYAL HERBERT HOSPITAL, WOOLWICH.)

The following report is the result of using the Danish method of treatment on thirty-one cases of scabies during the last three months. An interim report on eleven cases gave the stay in hospital as 4·5 days, owing to the men being kept in hospital till all signs of dermatitis had disappeared. Since then twenty further cases have been treated who were in hospital for

2·1 days only, dermatitis being so slight and clearing up so rapidly when the causative agent was removed, that it was not considered necessary to keep the men in hospital after the cure of the scabies.

Combining the two sets of figures, thirty-one cases have been in hospital for an average of 2·96 days.

Dermatitis due to treatment was absent, probably owing to the mode of application, which is by smearing on the skin and not by rubbing in.

The actual time of treatment is now reduced to twenty-four hours. Cases usually arrive in the afternoon, receive their first bath and application of the special ointment; go to bed and receive their second bath and ointment on the following morning, return to bed till tea-time and have a final bath in time for the evening discharge from hospital. No relapses have occurred during the period.

The preparation of the special ointment—Marcussen's prescription—is carried out successfully at the hospital dispensary.

There is no doubt that the method of treatment of scabies is more efficient, less irritating and quicker than any other form tried up to the present.

From clinical observation of these thirty-one cases, it would appear to be possible to treat the disease in the Army by detaining the men in hospital for twenty-four hours.

(Signed) A. T. Frost,
January 16, 1924. *Major, R.A.M.C.*

These reports are published as a matter of general interest.

This treatment was brought to the notice of the Director of Hygiene by Major G. S. Parkinson, D.S.O., who had used it with marked success in Gibraltar where he held the appointment of Deputy Assistant Director of Hygiene, and since the results of further trials carried out under the orders of the Director of Hygiene proved satisfactory, it has now been adopted as the standard method of treatment for scabies in the British Army.

Two points of importance should be noted: (1) Excess alkalinity must be avoided in the preparation of the ointment; (2) the ointment should be smeared on the skin and not rubbed in.

THE TREATMENT OF RINGWORM BY ROBERTSON'S METHOD.

By Captain R. A. MANSELL, M.B.E.
Royal Army Medical Corps.

This method of treating ringworm was described by Dr. James Robertson, M.B., D.P.H., Assistant Medical Officer of Health and Medical Officer of Schools, Blackburn, in the *British Medical Journal* for June 16, 1923, and has been used for the treatment of children of soldiers at Preston during the past half year with uniformly successful results.

The method was brought to my notice by Major J. E. Hoar, R.A.M.C., who first used it here, and who suggested the writing of this note.

Not the least of the advantages of this method is the substitution of a feeling of cheerful confidence in place of the previous pessimism, almost amounting to dismay, with which one was wont to regard the occurrence of ringworm. The period of treatment is short; the amount of time required is only a quarter of an hour a day, and the prospects of a rapid and complete cure appear to be 100 per cent.

The treatment is performed as follows:—

The hair of the whole head is cut as short as possible, and, if necessary, the areas affected are shaved. The scalp is then thoroughly washed with ether soap and dried. The following lotion is applied by means of a small pad of wool on a probe or forceps: calomel five grains, tincture iodi mitis one drachm, the mixture being stirred thoroughly with a glass rod until a brick-red precipitate is formed. Unless there is some special indication for treating only one portion of the scalp, it is best to decide to treat the whole, and for this purpose—as there is frequently some degree of reaction, more especially over active ringworm patches—the scalp is divided into six areas, one of which is treated with the lotion each day.

The lotion should be gently daubed on and not rubbed in, and it must be freshly prepared for each application. If it is applied at all roughly considerable pain and erythema—even blistering—of the part is apt to result. Care must be taken that the lotion does not run down from the scalp on to the skin of the face or neck.

The parts of the scalp which have not been treated with lotion are then well massaged with unguent. hydrarg. ammon., and the whole scalp is covered with clean lint and a bandage, or, better still, the parents are asked to provide three or four closely-fitting linen skull caps which can be easily washed and disinfected and are worn day and night.

The following day, when the covering is removed, those parts of the scalp which were not treated with the lotion on the previous day are carefully washed with ether soap, and the second area is treated with the lotion; the ointment is applied and the head covered as before; and so on, day by day, till the six areas have been treated.

If there is any marked or painful reaction to the lotion, the application of a mixture of three parts of olive oil and one part of castor oil usually clears it up very rapidly; and if the use of ether soap causes undue smarting, a freely lathering soap—such as "lux"—has been found to be quite efficacious.

After the head has been thus treated in areas with the lotion, the whole scalp may be given one final treatment all over in severe cases, but in ordinarily mild cases this has not been found to be necessary.

Then follows a week at least of thorough shampooing of the head every morning with ether soap if it can be tolerated, followed by the rubbing in of the oil mixture described above. This is persisted in until all the scales

and scurf have separated and the scalp is left in a clean and healthy condition.

This latter part of the treatment can be carried out, as a rule, in the patient's home, with occasional inspections to ensure that it is being properly done; but, in view of the fact that painful reaction may occur as the result of the application of the lotion, it would seem advisable that this should always be carried out by a medical officer.

Very few cases require more than one course of treatment in this way, provided that it is carefully and thoroughly carried out in the first instance; the average number of days needed to effect a cure has been about that noted by the originator of the treatment, i.e., just over a fortnight.

The essential points for success appear to be:—

(1) Very close cutting, or shaving, of the hair all over the head.

(2) General treatment of the whole scalp, even though only a small part of it appears to be infected.

(3) Maintenance of continual cleanliness and the application of an oil dressing to facilitate the separation of scurf and scales.

(4) Inspection of the whole of the affected family and their treatment, if necessary, to ensure that there is no risk from such sources of the patient becoming re-infected.

(5) Disinfection of articles of clothing and bedding which may carry or retain the spores of the disease both during and at the end of the treatment.

Echoes of the Past.

LETTER TO THE RIGHT HONOURABLE THE SECRETARY AT WAR ON THE MEDICAL DEPARTMENT OF THE ARMY.[1]

FROM SIR GEORGE BALLINGALL.

Regius Professor of Military Surgery in the University of Edinburgh.

UNIVERSITY OF EDINBURGH, DECEMBER 30, 1854.

SIR,—The attentive ear which you have readily given to many suggestions tending to the comfort, the health and efficiency of the soldier, encourages me to submit to your consideration the following observations on the Medical Department of the Army. If any apology is necessary for this intrusion, I trust it will be found in the interest which I naturally take in my old pupils, of whom some sixteen hundred have entered the class of Military Surgery during the thirty years that it has been under my tuition, and in a vivid recollection of what took place at the commencement, and particularly at the termination of the last war. There are few, if any, Medical Officers now in the Army who can speak from experience of the sanguine expecta-

[1] From an old book kindly lent by Dr. George Ballingall of St. Leonards-on-Sea.

tions which were formed and of the disappointment which subsequently ensued; and it is in the hope of suggesting a timely provision against the recurrence of such disappointment that I am induced to offer the following remarks.

In 1804, a Warrant or Order in Council was issued, "with the view of encouraging able and well-educated persons to enter into our service," and certain rates of full pay were specified as applicable to the several ranks of the Medical Department, with certain rates also of half pay *when reduced.* Here, so far as I recollect, was no condition as to the circumstances under which a staff or Regimental Surgeon might fall to be reduced, no specification of the length of service which should entitle a man to be continued on the half-pay list, nor was any mention made of a commuted allowance for the half-pay. The terms of that Warrant were, at the time, considered fair, or even liberal, and were looked upon as holding out something like a permanent provision for young men entering the public service. Whether there was any ambiguity in the terms of the Warrant, or whether its provisions were altogether misinterpreted, I do not stop to inquire, but proceed to state what were the harassing anxieties to individuals, and what the injuries to the public service which followed.

Many half-pay Medical Officers, when called upon to resume their duties, or to accept a commuted allowance for their half-pay, did not hesitate to consider, and to complain of this as something like a breach of faith, on the part of the public. Hundreds had entered the service under the misapprehension alluded to; many of them, after the termination of the war, had made great and laborious exertions to establish themselves in private practice; some had paid money for this; some had entered into partnership; some had formed engagements with pupils or apprentices; and others had accepted offices of public trust and responsibility—all of which considerations fell to be sacrificed if they were to return to the service. The alternative was considered hard, and particularly so in cases where gentlemen's health, although not so far impaired as to exempt them from duty, had been so far shaken as to induce them to seek a retirement on half-pay, and to dread the vicissitudes of climate necessarily implied in a return to full-pay.

Military and Naval Surgeons were thus placed in a very tantalizing position—one man sat down upon his half-pay, anxious to receive, and impatiently expecting, a call which might not come for years, perhaps never; another devoted himself to private practice, zealously using every effort to strengthen his connexions; and when he had so far succeeded, was called upon to resume his duties, or to make a sacrifice for which he was ill prepared. Instances were not wanting, particularly amongst those who had been employed on the General Medical Staff during the War, in which officers were, more than once, replaced upon full-pay, and after a very short service, were again reduced to half-pay. In one case, within my own knowledge, this happened not less than three times in a period of ten years.

Such were the consequences to individuals. What, again, were the consequences to the public service? The best qualified, the most energetic, and the most talented men, were often the most reluctant to move; and it may be inferred that many of the best of them did not return to the service. But this was not the only bad consequence. The extensive reduction, particularly of staff officers, which necessarily took place after the termination of the war, rendered the appointment of a Regimental Surgeon to be courted as one of the most secure and desirable positions, and this even by those who had previously served as Staff Surgeons. This was in some instances acceded to, and thus the usual routine of promotion inverted. In other instances, the surgeoncies of regiments, particularly those of the heavy dragoons, where the duty was light, the quarters good, and foreign or colonial service rare, were in several instances given to old and meritorious officers, as the best thing which could possibly be done for them, and in which there was every inducement to remain, and none to retire. While there were some remarkable exceptions, it is undeniable that there were many excellent men induced to hang on in the position of Regimental Surgeons, until the infirmities of age had made great encroachments, the eyes had become dim, the ears torpid, and the hands tremulous. In short, the extensive reduction of Medical Officers, the number liable to be called upon, and the number eventually replaced upon full-pay, retarded the promotion of the Medical Department to a most injurious extent, and constituted an evil of no common magnitude. Nor was this a passing evil. Within a few years, in the small garrison of Edinburgh, consisting of a regiment of infantry in the Castle and a regiment of cavalry in Piershill Barracks, we had several Assistant-Surgeons, each of them upwards of twenty years' standing; and so late as the year 1838, I attended an Assistant-Surgeon in the Dragoon Barracks who died upwards of forty-three years of age, and after twenty-three years' service. At that time the late Director-General told me that one of the last Assistant-Surgeons whom he had recommended for promotion had been twenty-six or twenty-seven years in the service. With what spirit or energy, I would ask, can men of this standing discharge their duties in the subordinate rank of an Assistant-Surgeon?

An extensive reduction of the Medical Staff, as well as the other departments of the Army, is a measure which the public would no doubt most willingly contemplate. The great and praiseworthy anxiety which at present prevails in the public mind for the relief of our wounded soldiers and seamen, and the natural desire that those brave men who have so freely shed their blood in the service of the country, should meet with the most efficient medical treatment, seems to render this an opportune moment for entering upon the whole question; and I would desire to consider it in the following points of view,—the description of young men whom it is desirable to attract to the service—the objections, real or imaginary, which some of the most considerate and eligible students make to it—and the means of obviating these.

It is certainly not a wise policy to encourage young men to enter the Army who do not intend to make a profession of it, but only look to spending a few years in a red coat, in the society of gentlemen, and then retiring into private life, not only without loss of time, but claiming credit for experience in their profession. That views of this nature are occasionally entertained, both by young men themselves and by their parents, I have reason to know, and have taken every opportunity of discouraging them. It is not for such men that I am going to plead. But there are others who have come forward on the present emergency in the most commendable spirit, prepared to devote themselves to the most perilous duties of the Service, and ready to take their places in the field and in the trenches. These young men have made themselves the children of the country, and I am well convinced that the public will be disposed to treat them liberally.

My position has given me perhaps more than common opportunities of observing the difficulties or objections which young men and their parents anticipate when about to embark in the Medical Service of the State. These I find to be—the extended course of education beyond that required by the colleges—the expense of their outfit—and the chance of being reduced after a short service, without any compensation for all this—the arduous service, and impaired health, by which the half-pay is sometimes earned, and the uncertain tenure by which this is held, until after a prolonged period of service.

As regards the subject of education, I consider the public, the profession, and the Queen's Service, greatly indebted to the heads of the Army and Navy Medical Departments, for the impulse they have given and the improvements they have been the means of effecting in this direction. To them I consider that the present improved code of Medical Education, compared with what it was some thirty years ago, is in a great measure due; but while, as an example, their regulations have been extensively useful, and have served a most praiseworthy purpose, they have been carried further, both in the collateral and strictly professional branches of study, than the Universities, the Colleges of Physicians and Surgeons, or the Apothecaries Company, have considered it necessary or expedient to follow. There may be some good things of which we may possibly have more than enough, and if anything superfluous is enjoined upon candidates for the public service, I make bold to say that it becomes not merely unnecessary, but injurious, by circumscribing the field of selection, and by consuming time and money which might be advantageously employed in concentrating their attention on those special duties incident to their department, on those diseases which the peculiarities of our service constantly present to their observation, and for the study of which this country and its colonies offer a field unknown to any other nation upon earth. If anything beyond the most extended course of education enjoined by the colleges is to be enforced upon the candidates for the public service, it should be that kind of instruction so eloquently and forcibly pointed at by

yourself and Sir De Lacy Evans, in the last and preceding sessions of Parliament. A course of lectures on Military Surgery, Military Hygiene, and Tropical Disease, would imply no heavy burden, and no sacrifice of time, even upon those who might not be successful in obtaining employment in the public service. "Such a course of instruction would not be thrown away either upon themselves or the public. Let gentlemen who may have so qualified themselves, have a preference in the intermediate approval of recruits, and in those numerous cases where troops are dispersed in small parties over the country, apart from their own surgeons. The soldiers would then meet with prompt and efficient treatment, while the public would have always at command a body of men, who, without prejudice to their qualifications as general practitioners, would be conversant with the duties of Military Surgeons, and thus competent to act on every emergency."

God forbid that I should be found to discourage the cultivation of literature and science amongst the medical officers of the Army. I should indeed be glad to see this elevated *as a preliminary study* amongst young men educating for all departments of the profession, civil or military. I am prepared to go as far in this direction as we can carry the public along with us; but parents, when investing their capital in the education of their sons, will inevitably look to the return they may expect from it; and I do not see why we should be laid open to the irony directed against some of the Utopian schemes of education proposed—that "there is such an effort in the present day to make all the young men philosophers, that there is some risk of our failing to make them surgeons." This is not the place, nor the occasion to enter into farther detail; but I cannot deny myself the opportunity of soliciting attention to the following sentiments expressed in an introductory lecture delivered to my class in 1846. "I do not undervalue those desirable, those necessary accomplishments which are creditable to the individual, and honourable to the profession. All I desire is to see the period generally allotted to professional study more judiciously adapted to the objects of the student. There are certain fundamental branches indispensable to all; but I must think that, in many instances, the nature and extent of compulsory study is ill proportioned to the probable wants of the individual, and what is necessary for the temporary purpose of an examination, takes the place of what would be permanently useful. Is it right that every medical student should be forced, whether by a compulsory law or by the terror of an examination, to consume his limited time in pursuits, to him it may be, of little importance, to the exclusion of those which are to constitute the business of his life? I have always advocated a high standard of literary and scientific attainment in gentlemen aspiring to a doctor's degree; but is it necessary that the studies requisite for this purpose should be so mixed with his professional course as to preclude a candidate for the Army from giving his attention to military hygiene? or the expectant of a naval appointment from studying the causes and prevention of disease in the fleet?"

I come now, sir, to the object which I more particularly proposed to myself in this letter, and which falls more especially within your province as the Finance Minister of the Army—the half-pay and retiring allowance to Medical Officers. I have long considered the want of an adequate retiring allowance after a reasonable length of service, and before the infirmities of age have crept on, as not only a hardship on individuals, but what is of more importance, one of the most serious drawbacks on the efficiency of the Medical Department of Her Majesty's service. This drawback becomes more remarkable when contrasted with the liberal provision upon which the Medical Officers of the Honourable East India Company are enabled to retire after a service comparatively short, and to this I would briefly advert. In either case, the Medical Officer must have attained the age of 21 before he can enter the service, and the Company's Surgeon may retire after seventeen years' service in India, upon the full pay of a captain, which, with an allowance from the medical funds at the several presidencies (to which his more liberal pay has enabled him to contribute) makes up a retirement of some £500 a year, at a period when he has not necessarily attained more than 39 years of age. What, again, is the case of the Queen's Surgeon? He cannot retire until after twenty-five years' service, on full-pay—the greater part of this time spent, perhaps, in the most unhealthy parts of India, or even in some worse climates—upon fifteen shillings a-day, and when he must necessarily be at least 46 years of age, seven years older than the Company's Surgeon. Be it observed also, that the former service is continuous, not necessarily interrupted by anything except bad health, or the will of the individual in taking advantage of an optional furlough, while the time of a Surgeon in the Queen's service may be broken in upon by alternate periods of full and of half pay, dependent, not upon the will of the individual, but upon the exigencies of the service. I am aware that the Company's Surgeons have their grievances, and complain of something very like an *ex post facto law*, depriving them of the relative retirements, compared with their military comrades which they expected on entering the service; and this leads me to say a word on the comparative position, generally, of Military and Medical Officers, and this in a spirit of equity, most assuredly not in a spirit of detraction.

The comparative exposure of Military and Medical Officers when in actual contact with the enemy, has not, I think, been much dwelt upon of late, particularly since the liberal sentiments towards the latter expressed in the House of Commons, by Sir Howard Douglas, Sir De Lacy Evans, Colonel Boldero, and others, and particularly since the publication of an admirable pamphlet by Mr. Martin, on the "Claims of Medical Officers to Military Honours,"—claims not impaired by the conduct of Mr. Wilson, Mr. Thomson, and others in the present campaign. But there are two points in which I think their comparative position has scarcely yet been done justice to—the excess of work to which Medical Officers are subjected in both extremes to an army, whether of labour or of rest. If the active

operations of a campaign are suspended by sickness, upon whom does the increase of duty fall? Who were the hardest worked men at Devna and at Varna? Again, all honour to their military comrades! But I would ask, who have worked harder or more continuously than the Medical Officers in the Crimea, and in the hospital at Scutari? While I readily admit that the military officer has the greatest risk and the hardest work in the day of battle, I would respectfully ask, who has the hardest work on the day following, and for many days after? The other point in which Medical Officers are sometimes looked upon as having inferior claims, is in comparison with those officers who have paid money for their commissions. Considering the expensive and protracted education which he must necessarily go through, an Assistant-Surgeon may now be said to purchase his commission at a much higher rate than an ensign, and with this material disadvantage, that he necessarily purchases it from six to ten years later in life; the purchase, moreover, as involved in the expense of education, is imperative on all Medical Officers; and while their military comrades are permitted to sell, even in some cases where the commission has not been purchased, the Medical Officer is in no case allowed to do so. Looking again to the comparative rates of retirement, we see provision made for the retirement of military officers on full-pay, after periods of service not very protracted, while no such thing is known in the medical department as a retirement on full-pay after any length of service.

Many years have not gone by since I could point to several of my class-fellows and cotemporaries who entered the service some eight-and-forty years ago, and who were still serving as surgeons of regiments. I grieve to think how unequal such men would have been to the duties devolving on Regimental Surgeons after the battles of Alma, of Balaklava, and of Inkermann; and it is with a view particularly to the rank of Regimental Surgeon that I would advocate a retirement on full-pay, or something approaching to it, to prevent the recurrence of cases such as I point at, where men were upwards of forty years in the discharge of regimental duties. The principle which I would urge is, that after a prolonged period of service a man's full-pay and his half-pay should approximate in amount to each other, and that ultimately the difference between the two should be so little, that a man would have every inducement to retire, and none to remain. A Surgeon is, by the existing regulations, entitled to retire on half-pay after *twenty-five* years' service, and it would not, I think, be considered unreasonable that he should then have a retirement equal to the full-pay of a Surgeon of *twenty* years standing—a little more than the half-pay upon which a Staff-Surgeon is at present entitled to retire. If a Medical Officer has served thirty years, without being promoted to a higher rank than that of a Regimental Surgeon, it is a misfortune to himself, and often a greater misfortune to the service. Such a man, generally speaking, becomes very unequal to any position in which the duties of an operating Surgeon are involved. Every facility should be given to his

retirement. He should be placed at the *maximum* of his expectations in this respect, and it would not be unreasonable that he should have a guinea a-day to retire upon—a trifle less than the full pay of his rank. All this is without reference to the full or half pay of the higher ranks in the department, and proceeds upon the equitable principle that an officer should be paid for his services rather than his rank. The half-pay for shorter periods of service, might, I think, easily be placed upon a more satisfactory footing than at present, more equitable to the profession, and not much, if at all, more burdensome to the public.

In a period short of ten years' service I do not consider that a young man has lost much ground if he desires to enter into private practice, and is not perhaps entitled to any permanent provision, unless in the exceptional cases of severe wounds or permanent disabilities contracted on service. But such a man has come forward to serve the public with the intention and desire of devoting himself to the service for life ; he has gone to an extra expense in his education and outfit ; and if reduced, care should be taken that he does not suffer a pecuniary loss at a time when his prospects of advancement have been cut short, and when he must necessarily be condemned to a period of inaction before he can establish himself in private practice. Would it then be too much to expect that a young man in this position should have the expense of his outfit and extra education repaid to him on a liberal scale, and a gratuity of one or more years full-pay, according to the length of time he may have served? After ten years employment in the service, a man, if he has made good use of his time, becomes a valuable servant to the public. He has lost ground in the race with his cotemporaries, some of whom may have established themselves in the very locality where, of all others, he had the best chance of success ; he has necessarily attained 31, it may be 36 years of age, and he has become accustomed to habits of deference to his professional authority and obedience to his prescriptions, not conducive to his advancement in private life,—as witness the few instances of success amongst the medical officers of the army and navy who were discharged at the end of the last war. It is for the public interest that a man of this standing should be encouraged to remain in the service by the prospect of speedy promotion, or, if reduced for the public convenience, he should have the option, if he so chooses, of remaining permanently on the half-pay of his rank. A period being thus fixed for retirement in the junior rank, I would propose that when an officer has gained one step in advance—when he has been promoted to the rank of Surgeon,—if reduced for the public interest, and again called upon to serve, he should, unless disabled by wounds or infirmities, have the alternative presented to him of either resuming his duties, or reverting to the half-pay of an Assistant-Surgeon, and so on throughout each superior rank—the principle being this, that whatever length of service, or whatever degree of merit entitles an officer to a step of promotion, the same should entitle him to the *permanent* half-pay of the rank from which he was promoted. This

would seem an arrangement more equitable than the commuted allowance —a measure, somewhat of an arbitrary character—where the allowance is calculated on principles, perhaps very intelligible to the actuary of an insurance office, but not, I believe, generally appreciated by the profession. The question as to the light in which the half-pay is to be looked upon—*questio valde vexata*—would thus be put upon a footing equally obvious and indisputable. The half-pay of each superior rank would fall to be looked upon as a retaining fee, the half-pay of the rank immediately below as a reward for past services. The Army and Navy Surgeon would then see distinctly, from the moment of entering the service, what the public had a right to demand of him, and what the extent of the sacrifice he must make if not prepared to obey the public call. When an officer, recently promoted, is in receipt of the half-pay of a rank in which he has done little service, it seems only reasonable that the public should have the right to call upon him to do more duty in that capacity, provided always that the call should not be postponed until the individual is so far advanced in life as to render it impossible for him to complete the periods of 25 or 30 years' actual service specified for retirement. If the national exigencies do not require a man, who has always been ready to move, to resume his duties at the active and useful period of his life, it would seem harsh, not to say unjust, to call upon him at an advanced age, when physical infirmities would necessarily preclude him from serving for the length of time entitling him to a permanent retirement. I have confined myself almost exclusively to a consideration of the position of Assistant and Regimental Surgeons, and this with the view of illustrating a principle, which, *mutatis mutandis*, may easily be applied to all other ranks —that of placing the half-pay after prolonged services, so nearly on a par with the full-pay, that there may be a comfortable retirement for men advanced in life. The objects which I have more immediately had in view, are the liberal treatment of those young Surgeons who have come forward on the present emergency, and who cannot expect to be retained in the service after the termination of the war—an encouragement to hale young Surgeons on half-pay to resume their duties in the service, by the prospect of a considerable sacrifice on the one hand and of a more liberal retirement on the other—the discouragement of superannuated Surgeons from remaining in the service, by giving them a maximum of retirement after a period of life when their energies begin to fail.

The advantages which I should expect from the proposed plan are the more speedy reduction of what has, not very graciously, been termed the dead-weight—the sequel of every war—and, above all, the greater efficiency of the medical department, by substituting young men in the vigour of life for those who are past their work—a measure which may obviously be carried into effect not only without loss, but with a saving to the public; inasmuch as the half-pay of the young Surgeon, saved by his return to the service, will be more than equivalent to the additional retirement given to

the old one who withdraws to make room for him. In the gallant officer commanding the Army in the Crimea, and in some of his comrades, we have at this moment brilliant examples of elderly men, as it were, excelling themselves—performing feats of activity and deeds of heroism which would have done honour to their younger days; yet I believe that the public mind was never more alive to the general impolicy of employing old men in the operations of war in any of its departments, nor was the public ever better prepared to reward liberally those who have spent their best days in the service of the State. I am in fact more apprehensive of being considered to have understated the claims of my profession, than of having over-rated the liberality of the public.

I have the honour to be,

SIR,

Your very faithful and obedient Servant,

GEO. BALLINGALL.

The Right Honourable SIDNEY HERBERT,
Secretary at War, &c., &c.

Travel.

FLOTSAM AND JETSAM.

By COLONEL S. F. CLARK.
Army Medical Service (R.P.)

II.

To get off the beaten track has always had a fascination for me, and it was domestic affairs alone that, in 1897, compelled me to decline a chance of going to Uganda. As far as I know, the fact that I had passed in Hindustani by the Lower Standard was the reason why this offer was made to me; the only other time that my linguistic zeal came in was when it caused me to be placed in medical charge of the Indian Artillery and their families at Hong Kong, *without extra pay.*

In one of his books lately, Sir Conan Doyle said that there is no place in the world that so many people have seen, without having visited it, as Socotra, so I am glad to be one of the small band of landsmen who have been ashore on that island. The opportunity came in 1893, when I was stationed at Aden, and I siezed it with both hands.

The G.O.C. troops at Aden was also Governor of that place, and, during my tour of service there he paid an official visit to the Sultans of Socotra, and of the chief parts of the Hadramaut—or Southern Arabia. As the trip was made in the Royal Indian Marine Transport "Mayo," it was decided to give the benefit of the sea voyage to a number of British

troops of the garrison, who were very debilitated from malaria, and I was appointed to the medical charge of them.

The party on board consisted of General John Jopp, his A.D.C., Colonel Symons of the South Wales Borderers, who was afterwards killed in the Boer War, while in command of the British Force at Talana Hill, Mrs. Symons, six officers, including myself, and seventy-seven invalids. One of the officers was O.C. troops (invalids), one was to take photographs, as he possessed the cumbrous tripod camera of those days, another was to make coloured sketches, the fourth was taken to benefit his health, and the fifth was musical entertainer, whose strong suit was Chevalier's coster songs.

Socotra is quite a large island, being over seventy miles long and about twenty-two wide at its broadest part. It is 150 miles east of Cape Guardafui, and about 600 miles from Aden, and is so placed that practically every ship that sails to or from Australia, India or the Far East, passes within sight of it, sometimes quite close, for many homeward bound vessels set a course to pick up the high lands of Socotra. The centre of the island is occupied, almost from end to end, by a chain of mountains, which attains a height of nearly 5,000 feet, while the coast line consists of low cliffs, or else of sandy shores. We saw some short rivers, which run from the mountains to the sea, but as little or no rain falls between May and October, many of them become dry during those months. There was plenty of vegetation to be seen in the valleys and up the high ground, including many date palms. We have all heard of the Socotrine aloe, while myrrh and frankincense are said to be obtainable also.

We did not see many of the inhabitants, although there are supposed to be several thousands of them, and those we did see struck us as being a cross between arab and negro, but the genuine Socotrine is reported to be of Arabic origin, and to live in the mountains. Since 1886 Socotra has been under British protection, and a small subsidy is paid to the Sultan of Kishin, who claims to be the owner of it.

We sailed from Aden on the evening of February 18, 1893, and cast anchor early on 21st off Tamareed, the capital, which is situated about the centre of the north coast of Socotra. The sea water was so remarkably clear that the anchor and cable lying at the bottom were as visible as if there was nothing between us and them, and each one of the multitude of little fishes that swam around us was as distinct as a goldfish in a crystal bowl. This was due not only to the astonishing clearness of the water, but also to the whiteness of the bed of the sea, which was composed of pounded up white coral.

We went ashore and found that we had really struck the "India's coral strand" of the hymn, for the beach was formed of finely ground coral, with lumps of the same thing lying all about; but there was a fly in the ointment, for these large pieces were full of the decaying corpses of the polyps, and they smelt so badly that the whole air was tainted. The romance of a coral strand was killed then and there.

Some of us accompanied the G.O.C. to the Sultan's "palace," which was the largest house in Tamareed, and which had a Union Jack flying from the top. We were shown into a large room and sat on native beds during the progress of the palaver which took place. The Sultan was a good-looking, middle-aged man of undoubted arab type, and he was presented with a bag of rupees, a carbine and ammunition, a carpet and a blanket. He was accompanied by a staff—or possibly a cabinet—of oldish men in white clothes, while a guard of honour of armed retainers was drawn up outside the building. These men were lightly clothed, as most of them had only a piece of once-white cloth wound round their middle and falling below their knees. Their head-dress consisted of either a turban or a fez, but each man had a rifle and a curved broad-bladed knife stuck in his waistband.

We then went for a short walk, and found that the few houses that existed were large and squarely built and undoubtedly designed for defence. There were also a number of hovels formed of matting and reeds, whose inhabitants doubtless went into the houses in the event of hostilities breaking out. The houses were solid, with thick walls and were quite white. As far as I can remember I think that they were built of blocks of coral. There were a number of plots in which vegetables were growing, each of them enclosed by a strong palisade of reeds bound together.

We remained at Socotra for two days, and spent the time amusing ourselves by walks and duck shooting. After the barren rocks of Aden it was very refreshing to see running water, green grass, trees and general vegetation, and we had great fun trying to catch a species of butterfly with wings on its tail, that was said to be unknown elsewhere. It was rumoured that some scientific men or society had asked us to try and get specimens of this insect, but we never saw one, although every flying thing was hotly pursued, under the firm impression each time that the real Simon Pure was at last within our grasp.

We sailed at 7 p.m., on the 22nd, and arrived at 3 p.m. next day at Kishin, in Arabia, near Ras Fartak. It is situated in a large bay, which has a bold rocky headland at each end. The beach was sandy, with no sign of coral reefs, while on land hills could be seen in every direction as far as the eye could reach. Except for some palm trees the ground looked very bare, but was reported to be fertile during the rains. We were much interested in seeing great ray fish—like huge skate—which leaped out of the water and fell down again on to the surface of the sea with a resounding smack, which could be heard a long way off. A few of us went in one of the ship's boats to look for something to shoot, but had to return, as we were unable to land owing to the shallow water extending so far out. Two of us then went to Kishin in a local boat, but it seemed a crazy craft and always on the point of capsizing, so that we were ready to swim at any moment. As soon as we landed on the beach a lot of Arabs came forward and shook hands with us in a most friendly manner, after which we

joined the G.O.C., his A.D.C., and Colonel Symons, who were being conducted to the "palace" by the Sultan—an old man of 70—and his vizier, who was a year older and had a green beard. This trip also shattered to pieces all one's childhood romances about the splendour of Arabian palaces and the glittering apparel and noble appearance of sultans.

As seems to be the case all over the world where law and order are not strong, the houses in Kishin were built for defence. They were surprisingly large, and many were bastioned, with very thick, high walls of stones and mud, and very small windows a long way from the ground. The outer doors were strong, and could be opened from up above by an arrangement of ropes. The palace was one of the largest houses, and had a Union Jack flying from a pole on its flat roof.

We entered, and were taken up various stairs into the council chamber, —a bare room with amusing mural decorations. Attached to the walls, all round the apartment, were sundry homely articles arranged in four rows. The top row was composed of small, cheap tea-trays, with red flowers painted on them—the kind of thing which is (or was) given away with a pound of tea—alternating with ordinary dinner plates. The second row consisted of small plates and round pieces of tin, while the other two rows were made up of small, round mats. Further embellishment was furnished by a number of empty beer bottles suspended from strings.

We sat on a bed, while the two old Arab magnates squatted against a wall and received gifts—the Sultan was given his tribute money, with a carbine, a large mirror, a big knife full of corkscrews and other gadgets, and some bottles of scent thrown in, while the vizier got a blanket and a shawl. Coffee was served, after which our photographer took a picture of the G.O.C. and the two arabs, sitting on some carpets, of which I have a copy.

Our hosts expressed great satisfaction with their presents, and the Sultan said that when he went into the jungle he would leave his photo with his wife. He also told us that he would hide the money at once, lest some other tribe should hear of it and attempt to win it.

After leaving the palace my companion and I found a large mosque, and we thought that we had now hit something worth seeing. We were uncertain as to whether our request to go in would be favourably received, or whether we were outraging all the feelings of Mohammedanism and would be knifed on the spot. The doorkeepers, or priests, or whatever they were, however, seemed friendly and signed to us to take off our boots and socks, after which they led us into a small dark room. We didn't like this, but it was only to have our feet washed, after which we were allowed into the mosque. It was a most disappointing place, simply a very large, lofty, empty room or hall, as big as an average country church in England, with a smooth floor, and three rows of pillars. There was no ornamentation of any kind, except a lot of Arabic writing on the walls and pillars—extracts from the Koran, no doubt. Then we ascended a dark, winding stair to the top of the minaret, after which we returned to the ship on the crazy local boat, and steamed off at 9 p.m.

Early next morning we arrived at Sherma—100 miles nearer Aden—but it was merely a collection of small fishermen's huts, with one large, well-built house for the headman. As we approached the coastal scenery was rather fine, it was rocky with numerous caves, and much striking geological strata. On shore was a large tomb, nearly as big as a local house, which was covered with flags which had been presented as votive offerings by dhows, or "buggalows," as they were called in the Hadramaut.

Three or four of us went ashore with the General before breakfast, and had a palaver with the headman's son—everybody seated on the floor. He was a nice looking young lad, with an appearance of high breeding that marked him out from his countrymen about him. In answer to a question as to what he did all day, he replied that he did nothing at all. I suppose work would have been derogatory, and games, or sport, as known to us, were non-existent. Sugar and water in tiny cups, flavoured with cinnamon, was handed round, and we were glad that the cups were small, for we manfully drank the concoction. In our honour the room was filled with a pungent, aromatic smoke.

The windows of this house were "glazed" with talc, which is exported from the place. We took a short walk to see where they got the substance from, after which we returned to the ship, which sailed at once for our next stopping place—Shehr—twenty-three miles further west.

This was much the largest place we had seen so far, and our arrival caused the utmost interest. There was a "palace," a leaning tower, and many large buildings of stone and mud, all protected on the landward side by a fine, high wall—well built and loopholed. Beyond were hills in every direction, while there was no harbour, but just an open roadstead, with a heavy surf breaking on the shore.

The local ruler came on board, and was accorded a guard of honour of twelve of our invalids. He was said to be a Jemadar of Hyderabad, Deccan, to which the place belongs somehow or other, and he soon returned to land, accompanied by the men of our party. We started in a steam launch and a cutter, but were transferred to shore boats specially constructed to go through the surf. They had high sides and very overhanging bows, and were manned by powerful rowers—who rumour said were slaves—who sat on the narrow gunwale as they pulled at their oars. Our photographer as nearly as possible fell into the sea during the transfer, but we got through the surf safely, and were carried ashore shoulder high. Hundreds of men were waiting for us, armed with matchlocks and knives, and, as we went through the lane which they formed, a salute was fired from some cannon.

In addition to these armed men, who were apparently a sort of guard of honour, there were crowds of other Arabs about, all of whom evinced much interest and curiosity in regard to us. The men came up openly, but the unfortunate women—who were just as keen to see us,—huddled together in little bunches at street corners, and obviously accepted the

position of being of no account. They were all dressed in garments of dark blue cloth, and most of them had their faces completely hidden by a thick veil, which had a transverse slit over the mouth. To get a better view of us, they placed two fingers of each hand in the angles of the slit, and held it up to their eyes. Most of them gave us furtive glances, and their whole demeanour raised the impression that they occupied a very degraded and subservient position in the life of the community.

We walked to the palace and had a pow-wow in a large durbar room, opened only for distinguished visitors. The local magnate then sought my professional advice about his health, and I diagnosed asthma, and sent him a large bottle of medicine from the ship, which, I trust, did him good.

When we left the building we were mobbed by the armed men outside, and at the General's request that they should give us an exhibition of some kind, they declared for a "slave dance." So we and the crowd surged along to a large open space, where our party selected a dried mud heap as a grand stand, from which to view the proceedings. The arabs formed themselves into six or eight companies, and went round in succession dancing, singing, yelling, waving drawn swords and daggers, and firing their matchlocks. They loaded as they danced, and fired their guns as they twirled them over their heads. The din was deafening, but the whole scene was most picturesque, and was the kind of thing one read about in travellers' tales. The town was looking on in its best clothes to the last baby, and the garments of the spectators gave a pleasing scheme of rich colouring to the event.

When the *tamasha* was over we went back to our ship, which lay at anchor all night. In the morning two mortars, with ammunition, were landed as a present to the Jemadar, and at 8 a.m. we sailed, and three hours later arrived at our next port, Makallah.

This was a large and, apparently, a very old town, but it presented a very dilapidated appearance. It looked as if an earthquake had visited it, for some of the big houses were falling to pieces and places were visible in the high ground behind, where landslips had occurred. It had a defensive wall on the land side, as at Shehr, with the usual large flat-topped houses that were almost young fortresses, and which had loopholes rather than windows. The great size of the houses was astonishing, standing four-square and built of stone and mud, while the palace was a surprisingly large building. Outside the wall were numerous small hovels of grass and matting, where the poorer people lived. Many native craft were anchored in the open harbour, but quite a good sea wall and landing stage of marble had been built. This ornamental stone was apparently obtainable in the vicinity. One end of the town wall was finished off as a fort, built out into the sea, and armed with some old guns which roared out a salute as we landed. We had a high opinion of the courage of the man who fired them.

The sea was full of fish, and many little boats came round us, offering

their finny catches for sale, but amidst this profusion of fresh fish we were amused when tinned herrings from England appeared on the breakfast table. Huge fish, that I think must have been tarpons, were on sale on land, and pieces were cut out of them and sold, just as butchers deal with carcases in our country.

We landed in the afternoon and visited the palace, in which the reception room contained very rickety looking new European furniture—the kind of thing that is made for sale to the unwary. I fear that somebody had made a big profit out of the headman of Makallah, in the matter of furnishing his palace.

After that we had a walk round, sight seeing, but word got about somehow that I was a doctor, and I soon had a crowd round me for whom I could do nothing. I was much struck by the aptness of the Scriptural phrase, "the maimed, the halt and the blind," for it exactly described those who sought my aid. I got one fee, for a well-to-do old man, with a cataract in one eye, gave me two round tins full of honey in the comb.

We lay at anchor all night, and next morning were joined by H.M.S. "Lapwing" from Aden, a small gunboat which came to add impressiveness to our visit. She caused much consternation in the evening by turning a searchlight on to the town. When a beam from it touched the crowded sea wall, or quay, it revealed a multitude of bare legs in action, as their owners fled to escape from the sun, which, we heard afterwards, they considered we had captured and turned to our own base uses.

A shooting party set forth in the morning but got nothing, and after lunch three of us, including the photographer, walked out a long way into the country, by the banks of a river, to a place where a hot and a cool spring of water existed side by side. There were pools of water here, with numerous date palms and maidenhair ferns—quite a little oasis. There was an appreciable amount of water in the river, which was evidently very wide in the rainy season.

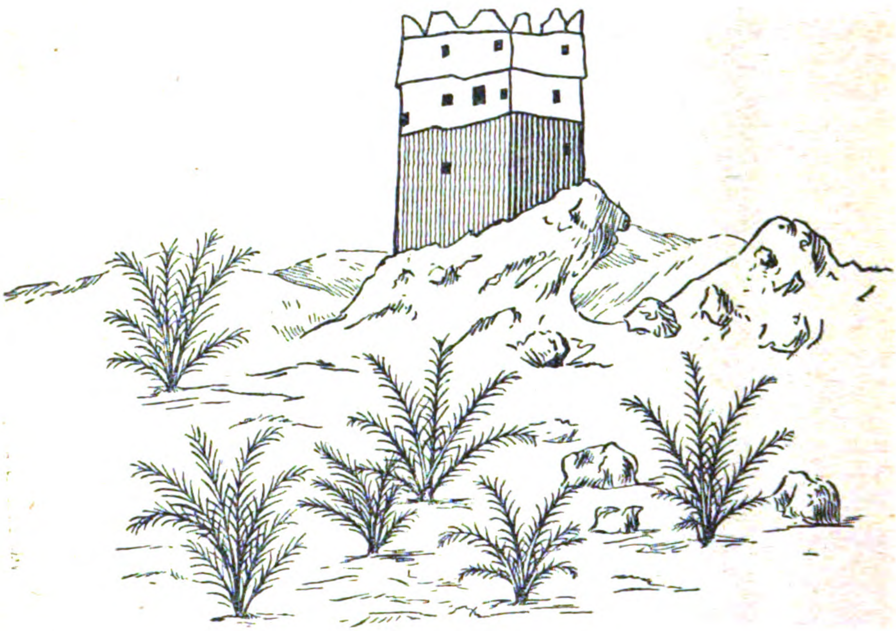
The country was very hilly, and each prominent position had a watch-tower or block-house. There was a regular chain of them, fairly close to each other, and near Makallah no fewer than thirteen of them could be seen at once. They were all square, strongly built and evidently were meant to be defended by their garrisons, but apparently were manned only when hostilities were expected. I enclose a sketch from a photograph, showing the most picturesque one that we saw, perched on a curiously-shaped rock. The whole atmosphere of the parts of Southern Arabia that we visited was one of provision against an enemy's attack—we even saw ploughmen at work with their matchlocks slung over their backs. I suppose our own land was in this state a few centuries ago.

We hurried back to be in time to see a war dance on the marble-faced quay: it was on the lines of what we had seen at Shehr, but was not so good, as not so many men took part in it.

We sailed at 11 p.m. on 26th and by daylight were at Bir Ali. I believe

that this place is marked on some atlases, but all we saw was one square tower and four palm trees in a bay. Not another building was visible. The scenery here was desolate—all volcanic rock—and as the local headman was reported to be fighting somewhere in the interior nobody went ashore, and we continued our voyage for Barhalfa, with the warship just ahead of us. Up to this place and a little beyond it the whole coast was quite volcanic, burnt up, black rock and stones, with numerous small craters. There was then a marked line of demarcation, at which this black, forbidding, forsaken looking coast, turned suddenly to an endless stretch of inviting white sand.

Like Bir Ali, Barhalfa did not seem to possess strong claims to be on the map, for it consisted of one square house and a few trees. An Arab



came off to us and apologized for the failure of Barhalfa to fly a Union Jack, by explaining that the headman had taken it away with him to the fighting against the Bedouins. One had not realized before that all sorts of unauthorized scrapping may go on under our flag, in the remote places of the world.

Our stay here was one of minutes only and we were off again with the ship rolling to a strong cross wind, and large "white horses" on a very blue sea—the little "lapwing" keeping us company, we steamed along all night, and in the morning found no sign of our escort, so our captain decided that we had come too far and turned the ship round again. After going ten miles we arrived at our objective—Sugera—where we found the warship at anchor. It was not a very large place and we went ashore, and

had the usual pow-wow with the local headman in a small room. We expected to be offered the usual tea, but this was the only occasion on which solid food was put before us. We sat on the floor in a circle round a large mat on which chupatties (very thin cakes of flour) and dishes of curry and rice were placed. Our hosts did not join in and it was a case of fingers before forks. We then took our leave and walked a long way in the hope of getting a shot at something but one hare was the total bag.

We were interested in seeing an Arab delinquent of some kind in the village. He was apparently under restraint as his ankles were shackled so closely together that he could just move and no more, but he was quite on his own, with no sign of a guard. His chance of making a successful bolt for liberty certainly did not look bright.

We had an exciting passage back to the ship in one of her boats, for we somehow or other got on to a large shoal or sandbank on which a good surf was running, and we were unable to reach our vessel until she floated a line out to us, attached to a lifebuoy. At 11 p.m. on February 28 we sailed for Aden—sixty miles away—and arrived there safely at daylight.

Current Literature.—Pathology.

Thyroidectomy and Immunity; Thyroidean Allergy. By M. A, Garibaldi (*Compte Rendus de l'Académie des Sciences*, clxxvi, No. 19, May 7, 1923).—A short review of various observations by the author and other writers on thyroidectomized animals. Such animals have increased powers of resistance to infections, and have been shown to be richer in hæmolysins, agglutinins and precipitins than normal control animals. They are also found to be hypersensitive to various foreign substances, although there has been no previous specific sensitization. He explains the discordant results obtained by different workers by classifying the various observations in three groups.

(1) State of hypersensibility (strong toxi-infections; large doses; soluble or very toxic antigens). Hypersensibility masks immunity.

(2) State of hyperimmunity (slight toxi-infections; small doses; solid or slightly toxic antigens). Immunity masks hypersensibility.

(3) State of isoimmunity (experimental conditions intermediate between the above). An actual intermingling of the phenomena of hypersensibility and immunity.

Thyroid insufficiency appears then to bring about an allergic condition which on mild excitation produces a marked defensive reaction. A powerful excitation on the other hand produces a state of inhibition, the result of which would be a condition of lowered immunity, while between these two extremes intermediate phenomena are found.

Complement Fixation in Treated and Untreated Leprosy. By E. W. Goodpasture (*Philippine Journal of Science*, xxii, No. 4, April, 1923, p. 425).—A reliable serological method of measuring the response of leprous patients to treatment with chaulmoogra oil and its products would be an invaluable addition to the present evidences of clinical improvement and the disappearances of acid-fast organisms from superficial lesions. An ideal method would be a specific complement-fixation test that would be positive in one hundred per cent of untreated cases, and that would become negative only after complete cure. The Wassermann reaction was found to be positive in sixty per cent of untreated nodular and mixed cases of leprosy, and in eighty-four per cent of similar cases treated with chaulmoogra oil or its products for a few months, but still bacteriologically positive. In sixteen cases of nodular and mixed leprosy that had become clinically and bacteriologically negative under treatment with chaulmoogra oil, the Wassermann reaction was uniformly negative. These observations show that the Wassermann reaction is hardly worthy of further investigation as a possible test of broad application in leprosy, although of considerable immunological interest. Using an antigen composed of a suspension of *Bacillus tuberculosis* (human), one hundred per cent positive, complement-fixation tests were obtained in twenty-four cases of nodular, mixed and anæsthetic lepers. In twenty cases of nodular and mixed leprosy, clinically and bacteriologically negative after treatment with chaulmoogra oil or its products, two were negative, three gave complete fixation, one was strongly positive and fourteen weakly positive. *B. tuberculosis* of the human type therefore gives promise of being an antigen that may be of service, and thorough investigation of it is strongly recommended.

Bacterial Vaccines by Mouth: A Critical Review. By A. Calmette (*Annales de l'Institut Pasteur*, xxxvii, October 10, 1923).—Since Pasteur, in 1880, first suggested producing immunity by the ingestion of dead bacteria, many trials have been made of the administration of bacterial vaccines by the mouth, mostly with very small success. Until the last few years, it was believed that bacteria could not pass through the intestinal mucous membrane in the absence of injury. Now, however, it is known that in mammals at least, each meal is followed by a veritable seeding of the blood, and that if there are mixed with the food certain easily recognizable bacteria, these are found several hours later in the lymph, the blood, the meserentic glands, and the lungs. The greater number of these bacteria is rapidly destroyed by normal phagocytosis. This absorption takes place normally through the lymphatic vessels in the villi, of which the epithelium is never sufficiently intact to prevent the leucocytes from passing. Moreover, constant desquamation is occurring, particularly during digestion. The natural guards against infection through these channels comprise the mucus, which covers the surface and prevents the active immigration of the leucocytes, the digestive

secretions which dissolve large numbers of bacteria, and, above all, the antibodies present in the blood. We should add the lytic substances described by Tworte and d'Herelle.

Typhoid and Paratyphoid Fever.—Various attempts at immunizing laboratory animals have been made by the administration of dead bacteria by the mouth, but with only moderate success until Besredka conceived the idea of administering bile before the vaccine. He observed that the bile increased markedly the desquamation of the intestine and so assisted the absorption of the dead bacteria. He found that for ten days after the administration of the vaccine, no immunity was developed, but after this, rabbits showed a definite immunity lasting about six weeks. Trials of this method have been made on human subjects during epidemics but the results are at present inconclusive. Moreover it is found that in the rabbit it is necessary to give a dose of bile of which the corresponding dose for a human subject would be 120-180 cubic centimetres. In view of the satisfactory results obtained by subcutaneous inoculation in these diseases it does not seem advisablet hat this method should be abandoned. The administration by the mouth, however, could a satisfactory technique be evolved, would have the advantage of being much more readily accepted by large numbers of people.

Bacillary Dysentery.—Vaccines of dead bacteria in the case of this disease have proved to be so highly toxic that it is impracticable to confer immunity by their subcutaneous injection. An effective alternative method of administration would, therefore, be of the utmost value. Shiga claimed in 1908 considerable success in immunizing both laboratory animals and human subjects, but these results appear to have been ignored in Europe until the occurrence of numbers of cases during the war. In 1918 Besredka took up the study of this question, and found that the ingestion of dead cultures of dysentery bacilli, even without the previous administration of bile produced the same symptoms as the living virus, and that a slight attack following a single meal of heated bacteria protected a rabbit against the intravenous inoculation of a dose of virus which killed the control animal in twenty-four hours. He was unable to demonstrate antibodies in the serum of vaccinated animals. Nicolle and Conseil have tried the method with success on human subjects. Further experiments are in progress in various centres of epidemic bacillary dysentery, and it is hoped that these will lead to success.

Cholera.—As the subcutaneous method has been found satisfactory in cholera, the same considerations apply to the use of the oral method as in the case of typhoid fever. Very little work in this direction has been done, but Masarki has shown that rabbits and guinea-pigs resist the ingestion of enormous doses of cholera vibrios. After being sensitized, however, by bile, rabbits are killed by the ingestion of virulent cultures. Trials on human subjects of the oral administration of cholera vaccine are at the present time being made in Russia by Tareassewitch.

Other Diseases.—Experiments have been made by various workers with

tuberculosis, pyogenic bacteria, diphtheria and plague, but with the exception of the last, no results of any value appear to have been obtained. In the case of plague, Leger and Baury published in 1922 a preliminary report of some successful attempts to immunize guinea-pigs, rabbits and monkeys by Besredka's bile method.

The author concludes that insufficient knowledge of the subject has been acquired for the oral administration of vaccine to be of much value at present. It promises, however, valuable development in the future.

Studies on the Nasopharyngeal Secretions from Patients with Common Colds. By Peter K. Olitsky, M.D., and James E. M'Cartney, M.D. (*Journ. of Exper. Med.*, xxxviii, 4, October 1, 1923).—Transmission experiments on human subjects with the filtered nasopharyngeal secretions showed that in very early cases of typical infectious common colds in the first three to eighteen hours of the disease, a similar condition can be transmitted to the infected individual. With the unheated, but not with the heated secretions from four of six such patients, the authors have succeeded in transmitting an affection indistinguishable from common cold to six supposedly normal subjects. The periods of incubation in the experimental disease varied from eight to forty-eight hours. They failed to obtain these results with the filtered secretions from cases of common colds eighteen and twenty hours after the onset of symptoms. It would appear that the secretions are more active in the early hours of the affection. They also failed in two instances in which colds were caused by exposure to the elements, or chilling of the body, and not by definite contact with other cases of common colds.

Intratracheal inoculations in rabbits with unfiltered and filtered nasopharyngeal washings from common colds induce no distinctive effects on the tissues, from which no constant pathogenic agent has as yet been recovered. This is in contrast to the findings of Olitsky and Gates in influenza.

Aerobic and anaerobic culture experiments were made from forty early cases of infectious common colds and although representatives of the three groups of anaerobic filter-passing, Gram-negative bacteria, described by Olitsky and Gates were found, *Bacterium pneumosintes* was not present in any case.

The authors summarize their conclusions as follows: The transmission of a clinical condition similar to typical, infectious common cold from man to man with the filtered nasopharyngeal washings of early cases of the disease indicates that the incitant is filtrable, thus confirming the earlier observations of Kruse and Foster.

Experiments on rabbits with these secretions and cultivation tests show that the materials derived from patients with common colds are distinct in effects from those of epidemic influenza.

Cultivations of the nasopharyngeal washings from forty cases and from

the lung tissue of inoculated rabbits, have failed to reveal any constant pathogenic agent, or incitant. None of these cultures, furthermore, yielded *B. pneumosintes*.

Notes on the Administration of Vaccine by the Mouth, more particularly with Reference to an Outbreak of Enteric Fever. By J. H. Harvey Pirrie and A. J. Orenstein, University of the Witwatersrand (*Med. Journ. of South Africa*, April, 1923.)—The authors state that although it has been admitted in a general way that oral administration of vaccine is not without effect, recent work indicates a change of opinion as regards infections acquired through the alimentary tract. Besredka, in 1919, showed that in typhoid and dysentery immunity is a property of the cells of the intestinal mucosa, and that immune bodies in the blood are overflow products; and he suggests that the immunity against typhoid invasion produced by subcutaneous administration of vaccine is solely due to its action on the intestinal mucous membrane. The same observer found that rabbits, when given virulent dysentery bacilli by the mouth, developed a condition comparable to the human disease, but that if they had previously been given killed dysentery bacilli by the mouth, they were found to have acquired immunity, but little or no evidence of antibody formation could be found in the blood.

Typhoid does not affect rabbits, but if the mucosa is artificially damaged by ox-bile before administration of bacilli, the intestines develop an inflammatory condition resembling the human disease. Previous "vaccination" by the mouth with bile and typhoid vaccine confers immunity.

In 1922 Nicolle and Conseil, in Tunis, successfully demonstrated the efficacy of vaccination by the mouth in the case of Malta fever and Shiga dysentery. In 1922 Vailliant published the results of a trial with typhoid in the north of France, where an outbreak occurred in a population of 2,000. Of these, 1,236 were given bile and vaccine by the mouth, 173 were inoculated subcutaneously, and between 500 and 600 remained unvaccinated. Of those given vaccine by the mouth, five developed the disease (but within two days of taking the vaccine, i.e., they were already infected); of those vaccinated subcutaneously, four developed the disease (also within a few days of inoculation), while among the unvaccinated fifty cases occurred. The authors report their own experiment on the Witwatersrand. In November, 1922, an outbreak of typhoid occurred among the natives in a mine. The average number employed was practically constant at 3,605. They lived in two compounds a mile apart, but they associated freely. One compound contained 1,850, and the other 1,750 natives, and the distribution of cases was proportionate. The disease was attributed to an unknown carrier. The water supply could not be incriminated, and there were no obvious carriers handling foodstuffs. Early in December it was decided to inoculate the natives, but owing to previous trouble in getting

them to submit to subcutaneous inoculation, it was decided to give them vaccine by the mouth by Besredka's method. About 3,500 were dealt with between January 4 and 12, approximately 100 being missed.

Between January 4 and February 24, 20 cases were admitted, 16 of whom had been vaccinated and 4 not; of the former 5 died, and of the latter 3. Those who had been vaccinated were admitted late in the disease, showing that the disease was probably incubating when they were vaccinated. The number of cases increased weekly from the beginning of the outbreak, there having been 2 during week ending October 28, 4 in week ending November 25 and December 9 and 16, then 9 in week ending 23rd, falling to 3 in the week ending 30th, and 2 in week ending January 6; so that the outbreak was apparently declining when vaccination was started on January 4. The value of Besredka's vaccination cannot, therefore, be said to have been perfectly demonstrated, but the authors consider there is reasonable ground for assuming its efficacy. In the week ending January 13 there were 5 cases, and the weekly curve then fell fairly regularly, being 3, 4, 2, 2, 1, 2, 0.

The advantages of oral administration are the absence of any objection on the part of the natives, who do all in their power to evade subcutaneous inoculation, and the absence of malaise, no single case having occurred in 3,500 natives, about 1,500 of whom had two doses and about 3,000 had three doses. In the whole outbreak the cases were fifty-three and the deaths seventeen.

As regards the preparation of the vaccine, several strains were used. They were grown in trypsinated ox-heart for eight hours, and then killed by 1 per cent phenol. The bacilli were then recovered by means of the Sharples centrifuge and the paste diluted down with normal saline containing 0·5 per cent phenol, so that a teaspoonful contained the equivalent of 0·015 gramme of dried bacilli. This was found to be about 40,000 million bacilli. The scheme of dosage was for each native to receive on three successive days one three-grain bile pill (B.P.) and one dose of 40,000 million bacilli.

Complement Fixation Tests in the Diagnosis of Tubercular Infections. By Arthur Sellars, M.D., and E. N. Ramsbottom, M.D. (from the *Journ. of Pathol. and Bacteriol.*, vol. xxv, No. 2.)—Owing to the improvement in the methods of complement fixation tests in recent years, attention has been directed to the value of this test in the diagnosis of tubercular infections. Results have, however, not been satisfactory: (1) Because it has been difficult to prepare a satisfactory antigen; (2) because the type of antigen used is strongly anticomplementary unless highly diluted; (3) because the serum of a tuberculous patient deviates only a relatively small amount of complement; and (4) because numbers of false positives occur, particularly in cases who have suffered from syphilis.

The authors reviewed all the different methods by which antigens have been prepared, selected and tried out five of these, and came to the conclusion that one of the five gave better results than the other four. This one is prepared by the method of Wang and Crockett. A growth of tubercle bacillus is taken from the surface of five per cent glycerine veal broth, and the lipoids are removed from the bacilli by repeated alternate extraction with ether and chloroform. The residue is dried and stored in the dark. The fluid antigen is prepared by grinding the residue with a suitable amount of saline.

The only point which need be noted in their method of performing the test is that only one dilution of complement be used. Complement is titrated both by itself and in the presence of antigen, and the amount of complement used in the test is 1 M.H.D. with antigen present plus 1 M.H.D. without antigen, so that 2 M.H.D., in addition to the amount deviated by the antigen, is used.

Having selected the most suitable antigen, the authors proceeded to test the sera of a number of cases which they divided into three groups:—

Group I included cases of syphilis and other conditions showing no clinical evidence of tubercle; 42·1 per cent of cases in this group gave a positive complement deviation reaction for tuberculosis.

Group II consisted of suspicious cases of tubercle lacking definite clinical evidence. Thirty-six per cent gave a positive reaction.

Group III was composed of cases showing definite clinical evidence of tuberculosis, though the bacillus had not been found. It gave ninety per cent of positives.

Cerebrospinal fluids from similar groups were also tested. Group I gave 30 per cent positives, Group II 50 per cent, Group III 100 per cent.

Further observations made were that the antigen had a very varying anticomplementary action with different complement. "Ice-box" fixation gave confusing results.

Conclusion: The authors are not satisfied that complement fixation tests afford a reliable means of clinical diagnosis in tuberculosis cases. A positive result is far from being a proof of tubercular infection.

Reviews.

ELEMENTS OF SURGICAL DIAGNOSIS. By Sir Alfred Pearce Gould. Sixth Edition, revised by Eric Pearce Gould, M.D., M.Ch.Oxon., F.R.C.S.Eng. With twenty radiographic plates. Pp. xiv and 739. London: Cassell and Co., Ltd. 1923. Price 12s. 6d. net.

Since the first appearance of this book, forty years ago, it has been through several editions and reprints, and it speaks well for the original edition that it has been possible to keep it up to date without undue expansion.

The present issue has been thoroughly revised, and many of the modern diagnostic methods have been introduced.

Since the introduction of skiagraphy, cystoscopy, Wassermann's reaction, complement deviation tests, and a host of other aids to diagnosis, the medical man has lost much of the art of clinical diagnosis. This little book shows clearly that by careful bedside examination a large majority of cases can be correctly diagnosed without these aids, and it should help to revive the lost art which is so important to the general practitioner who may not have these special means at his disposal, or whose patients are unable to meet the cost of special investigation.

If the methods of investigation described are faithfully followed out the more specialized tests will only be required for a minority of cases.

It is, however, to the student while acting as dresser or clinical clerk that it should prove most useful.

Like all books of this class it is at times very dogmatic and the impressions conveyed to the student will require to be corrected by reference to larger systematic works on surgery, but this feature can hardly be looked on as a fault.

While by no means covering the whole field of surgical diagnosis it most successfully fulfils the claim made in its title.

The volume is excellently produced and printed, a special feature being the beautiful reproduction of skiagrams. No typographical errors were detected and a good index is supplied.

HANDBOOK OF SURGERY. By George L. Chiene, M.B., C.M., F.R.C.S.Ed., Surgeon Edinburgh Royal Infirmary. Pp. xi and 592. Edinburgh: E. and S. Livingstone. 1923. Price 12s. 6d.

The Edinburgh Medical School have always excelled in the production of small manuals to assist the student in preparing for examination.

This handbook is a valuable addition to this series and is a well written and illustrated volume crammed with information. The student who has mastered its contents should be in a safe position when he confronts the examiners.

The difficulties involved in writing a book of this nature are very great, for to include all that should be included, and to omit what can with safety be omitted, requires much skill and judgment.

The author is to be congratulated both on his choice of subject matter and also on the interesting manner in which it has been presented, showing that not only is he a master of his art, but that he is in close touch with the medical student and understands his difficulties.

This volume is not intended to take the place of larger systematic works on surgery, but is really meant to be used for rapid revision before examination.

Realizing the limitations of such a book it is rather unfair to offer any criticism, but the author may welcome some hints for the future editions which are certain to be called for.

In the treatment of tetanus it is rather surprising to see the magnesium sulphate treatment still advocated. The report of the Tetanus Committee which considered the whole subject showed clearly that this method had no place in the treatment of the disease.

We would have liked to see gas gangrene mentioned if only to put the student on his guard against this serious condition.

In the discussion of syphilis, the chapter would be improved by giving the treatment at the end and not as it is, mixed up in the description of the clinical manifestations of the disease. Something more definite as to the doses and duration of treatment is also desirable.

It is curious to find gonorrhœa included under a large type heading Calculi in the Urethra. The disease is important enough to warrant a heading to itself. The description of the treatment of the disease is so condensed as to be of little value.

The section on abdominal surgery is particularly good, and in the short space devoted to it gives a mass of sound information and advice.

The method adopted for cerebral topography is new and very ingenious and is designed to avoid the necessity of remembering measurements, but we doubt if it will ease the student's burden very much.

There are other minor points which no doubt will be improved in future editions, but they do not seriously detract from the real value of the book as a work of revision for the student.

It is one of the few short manuals that are written in such a manner that they can be read with pleasure.

The book is of handy size, excellently printed and the illustrations are on the whole good.

We can predict a successful career for this latest addition to the student's library.

J. W. W.

The Urethra and the Urethroscope. By F. Carminow Doble, Temporary Captain, R.A.M.C., in charge of Gonorrhœal Division, Rochester Row Military Hospital; Honorary Consulting Outpatient Surgeon, St. Paul's Hospital for Skin and Genito-Urinary Diseases. Pp. xii and 120. London: Henry Frowde and Hodder and Stoughton. 1923. Price 10s. 6d.

This is the most complete work on the subject that has appeared in the English language. It deals only with urethroscopy as applied to diagnosis and treatment, and a careful perusal of its 120 pages will amply repay the time and trouble taken by one who wishes to treat gonorrhœa on modern scientific lines.

The book is divided into three parts: the first deals with anterior urethroscopes and the examination of the anterior urethra, the second with posterior urethroscopes and the examination of the posterior urethra, and the third with the examination of the female urethra. All the principal urethroscopes, both of British and Continental manufacture, are described in detail, so that anyone possessing one of these instruments can know at once the good, and bad, points of the instrument he possesses. A marked advance in urethroscopy is made by a device of the author which enables the posterior urethra to be examined without water distension. This consists of a long tube elbowed so as to fit into the posterior urethra and a longer lamp bracket to illuminate the opening which lies in the posterior urethra when the instrument is in position. This device is manufactured by the Holborn Surgical Instrument Company and can be fitted to the anterior urethroscope. Anyone who uses this instrument once will be convinced of its efficacy.

The book is well illustrated both by drawings of the instruments and coloured plates of the commoner lesions of the urethra. The latter are clearly and shortly described in the text as are also the procedures best calculated to remedy them.

Although chronic gonorrhœa has been treated for many centuries without the aid of the urethroscope it cannot be said that the treatment has left nothing to be desired or that it has been crowned with much success, but it stands to reason that it will be better treated when the various conditions causing the continuance of the discharge are seen and appropriately dealt with. This can be done only by the constant and systematic employment of the urethroscope in all cases of chronic gonorrhœa; and no one can consider himself competent to treat chronic gonorrhœa until he has mastered the urethroscope. Captain Doble has had a very large experience of urethroscopic work and his results are presented in this book. Provided one has a urethroscope, then with the exercise of a little patience and care and the aid of this book there is no reason why one should not become quite efficient in the treatment of chronic gonorrhœa.

SURGICAL DON'TS (AND DO'S). By C. Hamilton Whiteford, M.R.C.S., L.R.C.P. Pp. 46. Harrison and Sons, Ltd. Price 3s.

The contents of this booklet originally appeared in a series of articles published during the last thirteen years. The author, while aiming at no great literary style, endeavoured to cover a large field in a bright and breezy manner, and in doing so has managed to convey a good deal of useful information, without waste of words, and in an agreeable fashion.

Common sense is the keynote throughout, and several apt illustrations are quoted to emphasize its importance. It is rather difficult in a booklet arranged in small paragraphs as this is, to select any particular one for special mention or criticism, but those headed "Don'ts in General," "Scapegoats," "Intra-abdominal Adhesions," and "The Operating Theatre," are about the best.

The letterpress and paper are good, and the booklet is presented in an attractive style. Most surgeons will derive benefit from a perusal of this moderately-priced production. J. F. W.

AN INTRODUCTION TO SURGICAL UROLOGY. By W. K. Irwin, M.D. Aberd., F.R.C.S.Edin. Pp. vii and 180. London: Baillière, Tindall and Cox. 1923. Price 7s. 6d. net.

In this compact volume the author deals first with anatomy and the examination of patients, then discusses the chief genito-urinary symptoms and diseases, and concludes with a chapter on pathological conditions of the prostate. The book is concise and well written, and the author has succeeded in compiling a useful treatise which will appeal both to the practitioner and the student. M. B. H. R.

EMERGENCY OPERATIONS FOR GENERAL PRACTITIONERS ON LAND AND SEA. By H. C. Orrin, O.B.E., F.R.C.S.Ed. Pp. xi and 135 London: Baillière, Tindall and Cox. 1923. Price 7s. 6d.

This little book of only 135 pages covers a very wide field of Surgery. It is admittedly for the use of those medical men who are not in the way of operative surgery, and who may find themselves called upon to do emergency operations when at sea or in remote places. The first part dealing with anæsthetics is excellent, especially the account of spinal anæthesia, in which the essential anatomical points are clearly brought out; the rest of the book is not up to the same standard, as the author has wandered from his objective of providing a *vade mecum* for the general practitioner, and described, in many cases, complicated operative procedures with very little detail; for instance, in the operation for acute mastoid abscess, which is discussed in half a page, and in which the operator is told to open up the mastoid antrum if no sinus is found, there is no mention of the facial nerve or of the anatomical traps which are so easy to fall into in this operation. Again, nerve union is surely not a surgical emergency,

but it is here described, and without any detail of the very special technique which those who have any experience in this work know to be so essential to success. There are several very obvious anatomical mistakes, as on page 81, where it is stated that the radial nerve is internal to the radial artery, and on page 118 where the flexor carpi radialis "longior" is mentioned. In the main this book fails in its object for two reasons: (1) It pre-supposes in the general practitioner a knowledge of anatomy and of operative technique which he unquestionably does not possess; and (2) it covers too wide a field in too short a space. The book is well got up and admirably illustrated E.L.F.

Notices.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts, and commands at home and abroad.

All such Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notified at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Any demand for *reprints, additional to the above*, or for excerpts must be forwarded at the time of submission of the article for publication.

Matter intended for the Corps News should reach the Editor not later than the 15th of each month for the following month's issue. Notices of Births, Marriages, and Deaths are inserted free of charge to subscribers. All these communications should be written upon one side of the paper only; they should by preference be type-written; but, if not, all proper names should be written in capital letters (or printed) to avoid mistakes, and be addressed: The Editor, "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS," War Office, Whitehall, S.W.1.

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Subcriptions for the Corps News Supplement separate from the Journal cannot be accepted from Officers on the Active List unless they are also subscribing to the Journal.

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Journal

of the

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Original Communications.

AMŒBIASIS IN SECUNDERABAD.

By CAPTAIN S. SMITH.
Royal Army Medical Corps.

ÆTIOLOGY.

SECUNDERABAD shares with Bangalore the unenviable reputation of having for British troops the highest average yearly incidence of amœbic dysentery in India. The average admission-rate for dysentery in this station during the past eight years has been 38·12 per mille as compared with a corresponding rate of 10·18 per mille for India as a whole. On the other hand the incidence of amœbiasis amongst Indian troops has not been high, much less in fact than that recorded for many of the trans-Indus stations in the north.

It is an interesting fact that the dysentery curve for British troops showed an abrupt rise in 1913 to 23·9 per mille, the average for the previous four years being only 5·9 per mille.

It is also interesting to note that the admission-rate for other diarrhœal diseases, i.e., colitis (non-dysenteric), diarrhœa, enteric fever, etc., is relatively low in Secunderabad.

Some authorities state that amœbic dysentery has no marked seasonal variation, although H. M. Woodcock [1] noted that the disease was especially prevalent in Egypt during the month of August.

Records taken from this station during the past nine years show a very definite increase of cases during the wet month of July and the fly-bearing month of August.

The incidence of dysentery amongst Indian troops does not appear to share this seasonal variation developed to the same degree.

METHOD OF SPREAD.

As regards the means of transmission, authorities appear to differ, for while all are agreed that it is the *Entamœba histolytica* in its encysted form evacuated in the stools of healthy or convalescent carriers which forms the infecting agent, the manner in which this organism is conveyed from man to man is still largely a matter of conjecture. House-flies [2] have definitely been proved capable of conveying particles of fæces containing *E. histolytica* cysts in their gut; and as far as this station is concerned, any indirect evidence we have goes to implicate some variety of domestic fly as the chief vehicle of transmission. C. Craig [3] noted that in Mexico amœbic dysentery was prevalent in August and September when a plague of flies was also seen. An interesting account is given in the official history of the war [4] of the experiments carried out by Wenyon and Connor with a view to ascertaining facts concerning the carriage of *E. histolytica* by flies.

Many authorities quote a polluted water supply as an important factor in the spread of amœbic dysentery, but this can hardly be the case as regards, at any rate, the European population of this station, their water supply being entirely above suspicion; nor does the geographical distribution suggest that the disease is water-borne.

A notable feature of dysentery in Secunderabad (and probably also elsewhere) is the "evenness" of its incidence amongst the various British units. It was thought at one time that the carrier (especially the native carrier employed in the cookhouse) might be himself the transmitting agent, his fingers conveying the infection to the soldiers' food, but if this were so one would expect a far more localized rate of spread than has actually been the case. Careful periodic examinations of the stools of all natives employed in the preparation or conveyance of food have been made during the past three years by the D.A.D.M.S. (San.), but although many carriers have been found no close relationship between these and the spread of dysentery has been traced; nor does the spread of the disease in any one regiment appear to depend to any marked degree on the number of chronically infected British soldiers in that unit; for units newly arrived from non-dysenteric stations suffer just as severely as those that have been in the station some time.

Chart I compares the incidence of simple diarrhœa and dysentery during a consecutive twenty-two weeks of 1923. It will be noted that the maximum incidence for both diseases falls in the same week and also that there is a general similarity between the two curves suggesting the possibility of some common infecting agent (? the domestic fly) for the two diseases.

Chart II compares the average rainfall for the years 1914, 1915, 1916, with the incidence of dysentery for the same three years. Here it is to be noted that although the curve for dysentery follows that for the average rainfall fairly closely yet the maximum month for dysentery (August) does not correspond with that for the rainfall, thus suggesting a close though indirect connexion between the two. We know that following the heavy

rainfalls of the second half of June and of July, the comparatively warm and sunny month of August produces a huge crop of flies and thus again we obtain indirect evidence of their relationship to dysentery.

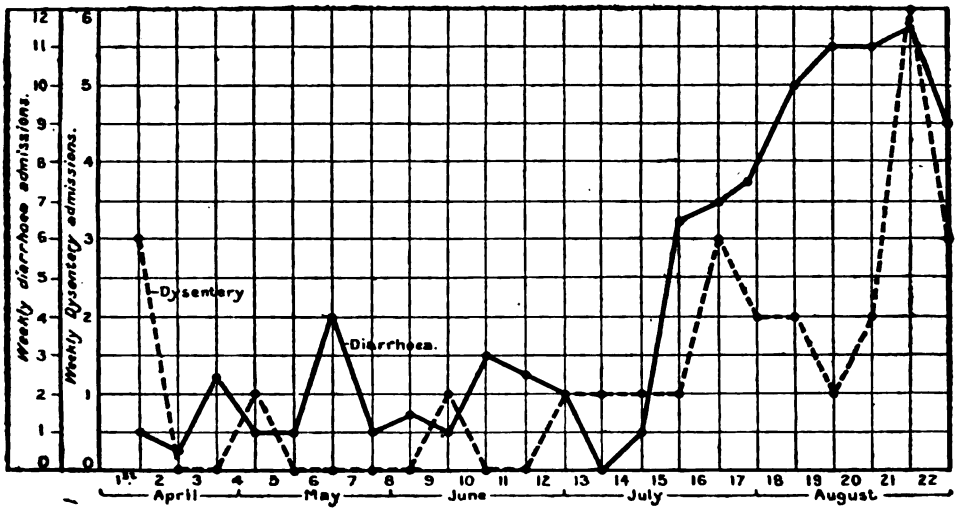

CHART I.

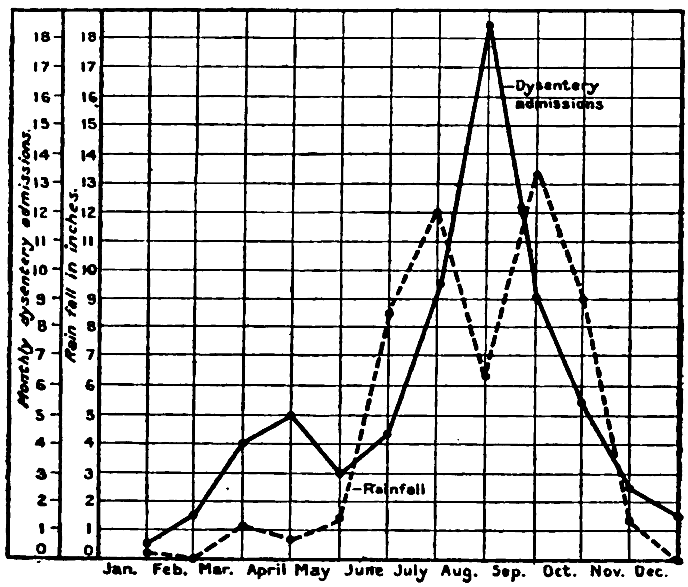

CHART II.

INCUBATION PERIOD.

Authorities differ as to the average length of the incubation period of dysentery. Walker and Sellards produced typical dysentery in 4 out of 20 cases in from twenty to ninety-five days after the ingestion of cyst-infected material (the remaining 16 cases had parasites but never

suffered from clinical dysentery). From these and other experiments the average incubation period is given as sixty-four days [5]. On the other hand, I have come across many cases in which the onset has been very sudden, almost explosive in fact, and referable by the patient at any rate to some indiscretion in diet some few hours previously. It is extremely common also to date the onset a few hours or days after the return from a long railway journey during which time no adequate attention to protection of food from flies or to proper regulation of the bowels has been possible. Again, recruits and fresh arrivals are often admitted with dysentery a few days after their landing in this country, and although it is possible that they contracted the disease on the transport or even in camp at home (this latter possibility has recently been brought home to us by the work of Dobell [6] and others), it would appear more probable that during the long sea voyage with the very limited opportunities for exercise afforded they had allowed their colons to get into an unhealthy state and fell easy victims to the attacks of *E. histolytica* on arrival in a district where the disease is endemic. For these reasons, shadowy and unconvincing though they may be, I very much doubt if there is any such thing as an incubation period for amœbic dysentery in the accepted meaning of the term in a station such as this where the disease is endemic and universal. Most of us during the "susceptible" months doubtless harbour numbers of the organisms which are only awaiting some temporary derangement of the intestinal mucosa, produced maybe by constipation, maybe by diarrhœa, to initiate their attack. Once conditions are suitable for their growth very few days or even hours may suffice for the onset of symptoms. Another "wisp" of evidence in favour of my contention that the incubation period of amœbic dysentery may be extremely short is afforded by a scrutiny of certain other intestinal affections commonly believed to be transmitted by flies. The most prevalent months for jaundice, which is known to follow commonly ten to fourteen days after an intestinal upset, are August and especially September. September is the prevailing month for the enteric group which is known to have an incubation period averaging fourteen to twenty-one days.

The monthly curve for common diarrhœa, which may supervene as most of us know to our cost very few hours after an indiscretion in diet, follows very closely that for dysentery. Diarrhœa is generally assumed to be largely a fly-borne disease, and it would appear at least suggestive that amœbic dysentery is also conveyed by flies. The fly month is also the dysentery month.

If on the other hand an average incubation period of sixty-four days be accepted the theory of fly-transmission must be largely abandoned, as there are very few flies to be seen during the hot dry months of April and May, when presumedly infection would have occurred in the great majority of cases.

Protozoology.

Concerning this highly controversial aspect of amœbiasis I have little to say. A bewildering bibliography has grown up round the subject during

the past few years, and it would be unseemly were I, a mere tyro in such matters, to add my remarks at full length. It need only be said that a fairly severe standard is taken before a positive result of dysentery is accepted, the inclusion of one or more blood-cells in the entamœba being our sheet-anchor in doubtful cases.

Dobell has stated that stool examinations during the week following a full course of emetine injections are of little value as an indication of cure, many cases which later pass numerous cysts fail to produce them during that week, and vice versa he found that a considerable series of cases which passed active amœbæ or cysts during the week following cessation of treatment never again passed any, and were in fact cures. For this reason six to eight stool examinations are made during the four to six weeks following discharge from hospital.

In no instance, as far as this station is concerned, has bacillary dysentery been found as a complication of amœbiasis, although in all cases which do not quickly react to emetine, or in which fever and severe diarrhœa are a marked feature, a search is made for the *B. dysenteriæ* and the usual cultural and fermentation tests are carried out.

Lambliasis has been a fairly common complication of the more chronic cases. The various nematode and trematode ova were commonly found in the stools of native carriers, but rarely in those of the European community. Coccidia cysts were common in both Europeans and natives.

Blood Picture.—The only departure from the normal appears to be a moderate eosinophilia, although this sign was not sufficiently constant to be of any great diagnostic value.

In nine cases of proved dysentery the eosinophiles averaged 4·74 per cent, in six of these the average being 6·3 per cent. In twenty-five cases (non-dysenteric) picked at random, the average eosinophile count was 1·44 per cent. In eight cases of catarrhal jaundice the eosinophiles averaged 2·7 per cent. This eosinophilia would appear to be more a sign of lower bowel irritation than in any way directly attributable to the *E. histolytica* as we have found no corresponding increase in the eosinophile count in hepatitis or amœbic abscess. Fisher [7] has found no marked or constant change in the blood picture of amœbic dysentery.

Clinical Groups.

Two main clinical groups of the disease have been met with in our series of about 180 cases collected during the past three years.

Group I associated with diarrhœa, with or without the passage of blood and mucus, in fact, clinical dysentery.

Group II associated with colic and constipation (including the important pseudo-appendicitis group).

While cases belonging to the first group are most commonly met with, constituting at least four-fifths of the whole, examples of the second type are not uncommon, and are much more difficult to recognize; dysentery is often not at first suspected, and the stools may remain negative to the *E. histolytica* for many days.

The site of the initial lesion or lesions would appear to be an important factor in determining the clinical group into which any given case may fall, although post-mortem evidence is seldom forthcoming. In those cases in which the cæcum, ascending colon, and first half of the transverse colon bear the brunt of the attack, pain over McBurney's point, colic, constipation and frequent negative stool examinations are the rule, whereas if the second half of the transverse colon and sigmoid colon are chiefly or primarily affected the ordinary symptoms of clinical dysentery, with the passage of frequent slimy and blood-stained stools containing numerous amœbæ, are met with.

In the first group all degrees of severity of symptoms occur. The following types may be recognized in any considerable series :—

(1) *Acute Fulminating or Choleraic.*—The patient is commonly brought into hospital on the morning following a heavy meal overnight. Onset is very sudden, almost explosive; the patient is usually semi-conscious, and severely collapsed on admission; with cold, clammy skin, pinched and pallid face, sunken eyes, and blue lips, his pulse running, thready, and scarcely palpable. He commonly complains of cramps in the limbs, and is very restless, both signs of marked dehydration; there is severe abdominal pain, marked tenesmus, and the constant passage per rectum of almost pure blood containing shreds of mucus. These bloody stools are loaded with *E. histolytica* ingesting red cells. I have seen three of these cases during the past three years, and very alarming they were. They occurred during the height of the dysentery season when ptomaine poisoning was prevalent and cholera was near at hand. An intravenous saline injection was necessary in two of the three cases. Emetine had an almost magical effect in all three cases, and men who were apparently moribund in the morning were out of danger by the same evening.

(2) *Acute Toxic.*—There is moderate fever of a remittent type for four to six days. The tongue is dry and covered with a brown fur. There is considerable abdominal pain, tenesmus, and the passage of twelve to thirty typical blood-stained dysenteric stools in the twenty-four hours. These cases clinically resemble typical bacillary dysentery; the similarity is the closer as in two cases at least severe joint pains in the ankles and knees with a moderate degree of fluid in the affected joints occurred at the end of the first week. They do not respond to treatment as rapidly as the first more explosive group, and are apt to relapse both during and after treatment.

(3) *Acute* (*non-toxic*).—There is no fever, or only a moderate degree which subsides after twenty-four hours. The tongue is slightly coated or normal; there is moderate abdominal pain for the first day or two only, often localized to the left iliac fossa where the thickened œdematous gut can be rolled under the fingers. There is moderate diarrhœa with the passage of six to twelve semi-fluid blood and mucus-streaked stools during the first twenty-four hours, after which the patient is commonly constipated.

This is the commonest type of case met with, constituting at least two-

thirds of the whole. The cases quickly react to treatment and show but little tendency to relapse.

(4) *Chronic* or mild.—Patient commonly complains of slight diarrhœa alternating with constipation, occasionally slime but no macroscopic blood is to be seen in the stools.

This class of case is commonly missed as the symptoms are often not sufficiently severe to cause the patient to go into hospital.

As some indication of the frequency of the various types the following figures from our hospital records may be quoted of a series of fifty-five cases.

15 had	0—1	stool during first twenty-four hours		
14 had	2—5	stools ,, ,, ,, ,,		
16 had	6—10	,, ,, ,, ,, ,,		
7 had	11—15	,, ,, ,, ,, ,,		
1 had	16—20	,, ,, ,, ,, ,,		
2 had	36	,, ,, ,, ,, ,,	(greatest number in any day—45)	

The symptoms exhibited by the second type are often very confusing and may not suggest amœbiasis. Amongst the most baffling of all are what might be called the *pseudo-appendicitis* group, in which the symptoms of pain, tenderness and rigidity in the region of McBurney's point are present.

These cases may present some or all of the signs of true appendicitis and one is often kept on tenter-hooks for some hours before coming to a decision as to whether or not immediate operation is necessary. One is seldom aided by a stool examination, as negative results or absolute constipation may persist for some days in cases of undoubted dysentery.

Most recent authorities call attention to the similarity between the two conditions and in the recently published official history of the war [5] great stress is rightly laid on the difficulties in diagnosis.

The following is typical of the series:—

Case 1.—Lieutenant J., admitted to B.S.H., Secunderabad, on April 26, 1923, diagnosis (?) appendicitis. Patient had been constipated for some days. On the evening of the day before admission he had noticed a general "rumbling" in the abdomen and slight colic. The following morning he complained of general abdominal pain and vomited twice. He was seen by Captain D. C. Scott, R.A.M.C., at 8.30 a.m., who noted general abdominal tenderness not localized to any one region. By 12.30 the pain was more severe and the abdomen was rigid, patient could only rest with the knees drawn up; there was now pain and rigidity in the right iliac fossa. By 5 p.m. the pain was continuous, the abdomen was rigid with marked tenderness on the right side and patient was admitted to hospital. On admission his temperature was 101° F., pulse 120, respirations 36, the abdomen was rigid and did not move on respiration, his tongue was furred. He complained of generalized abdominal pain, most marked in the right iliac fossa. There was definite but not very marked tenderness and rigidity on palpation over McBurney's point. A poor enema result was examined for *E. histolytica* but none were found. A blood smear was negative to malaria. He was seen by several medical officers and opinion was divided

as to whether his condition necessitated immediate operation. An expectant policy was adopted. During the night his temperature and pulse dropped. By the following morning the pain was less severe and more definitely localized to the region of McBurney's point. An indefinite swelling could be felt on deep palpation in this area which resembled a thickened and œdematous cæcum. His temperature was 101° F., his pulse-rate 100. He was very thirsty, appeared drowsy and had diarrhœa. All stools were examined with negative result. A hypodermic injection of half a grain of emetine was given and the injection repeated next morning. Following the emetine injections his general and local condition gradually improved and he was discharged to duty a week later. Four days after discharge he was re-admitted suffering from typical dysentery and numerous entamœbæ were found in his stools.

The diagnosis is therefore in certain cases very difficult.

Some of the chief points in the differential diagnosis of dysenteric pseudo-appendicitis from true appendicitis are summarized below.

In the former condition the pain is not usually so localized nor is it so acute as in the latter. Palpation over McBurney's point produces tenderness but not acute pain, and in some cases may relieve the pain (this is also occasionally noted in appendicitis). The "boarding" of the abdomen is not so marked. The patient looks ill but has not the anxious apprehensive expression typical of an acute abdomen. The temperature is often high (102°-103° F.), out of proportion to the severity of the abdominal symptoms, while the pulse, which may be rapid on admission, tends to decrease in rate after a few hours' rest in bed. The tongue is only slightly coated or may be clean in dysentery, and diarrhœa may commence a few hours after admission. The total blood-count is normal and there may be a relative eosinophilia.

In spite of every care, however, a definite diagnosis often cannot be made during the first twenty-four hours. It is advisable to give emetine as soon as possible after admission in all doubtful cases, the effect produced by this drug being in itself of great diagnostic value.

In addition to the above-mentioned type of case where the cæcum and not the appendix is primarily at fault, *true appendicitis* of dysenteric origin is by no means uncommon.

Captain D. C. Scott [8] operated on one such case. The appendix was gangrenous and almost perforated. On section it was found to contain a date-stone on the outer lining of which were numerous active amœbæ. It is interesting to note that the patient had bought some dates from a hawker and eaten them only two days before admission.

Patients are also occasionally admitted for colic, commonly in the region of the transverse colon, and constipation, and it may be several days after admission before the passage of a slimy stool or a chance examination of a stool gives the clue to the condition.

Relapses.—Whilst emetine, no matter how given or in what form, effects a speedy and complete cure in the great majority of cases if given in

sufficient dosage (i.e., twelve to fifteen grains of emetine-hydrochloride or its equivalent), there are some individuals on whom it appears to have very little effect and who continue to pass active amœbæ after a full course of the drug. The treatment of these cases often forms a difficult problem; they may remain fairly well in hospital while on a carefully restricted diet and may be occasionally passing a few degenerated amœbæ or cysts; if when passing normal stools they are sent back to duty, they return to hospital a few weeks later as bad as ever they were. As an example of how resistant to emetine treatment some of these cases are, the following case may be quoted.

Case 2.—Private D. was first admitted to hospital in January, 1923, suffering from amœbic dysentery. He received twelve grains of emetine by injection. He was readmitted in April and had a second full course of twelve grains of emetine. He was re-admitted in June and received six grains of emetine by injection and a total of 195 grains of pulv. ipecac. by the mouth. He was again admitted in September and received 2 grains of emetine by injection, daily bowel washes of a solution of emetine hydrochloride, 4 grains to the pint of water and 195 grains of pulv. ipecac. by the mouth. During the nine months he had thirty-two grains of emetine by hypodermic injection, a considerable amount of the same drug in the form of bowel washes and 390 grains of pulv. ipecac. by the mouth, and yet it would require considerable boldness to lay very great odds against an early recurrence of the disease.

Another interesting feature which amœbic dysentery shares with certain other diseases, such for example as malaria, is that once a patient has relapsed he shows a progressive tendency to further relapse; one attack therefore appears to confer little or no immunity against subsequent attacks. The tendency to progressive relapses may be shown thus:—

Out of 110 cases of which I have fairly complete notes, 15, or 13·6 per cent, relapsed. Of the 15 who relapsed once, 5, or $33\frac{1}{3}$ per cent, relapsed a second time. Of the five who relapsed twice, 3, or 60 per cent, relapsed three or more times.

It has been shown that emetine has little effect on the *E. histolytica* in any but strong solutions; *in vitro* quinine being much more efficacious. From this it is argued that in man emetine can have practically no direct deleterious action on the entamœba in the dilution in which it reaches the organism. It must therefore act in some indirect manner, possibly by reactivating a dormant hormone in the normal individual who reacts to the drug. It is possible that in those patients for whom emetine has but little curative action, this hormone is absent or has been changed in some way, so that the emetine is unable to wake it out of its trance.

Treatment.

(*a*) *Medicinal.*—As stated above our sheet-anchor has been emetine-hydrochloride administered by hypodermic injection, every fresh case receiving one grain of the drug on twelve successive days. In a few of the

very acute or fulminating cases $1\frac{1}{2}$ grains (*but never more*) have been given daily in divided doses for the first few days. In all acute cases, and more especially in the fulminating variety, it is of the utmost importance that emetine treatment be commenced as early as possible, no time being wasted in waiting for a laboratory report before the injections are commenced. In addition to the above treatment, every case receives at the onset an ounce of castor oil, with or without (preferably without) the addition of tr. opii. Any subsequent constipation is treated with sodium sulphate, two to four drachms in daily doses. Relapse cases receive a quantity of emetine varying according to the interval between the relapse and the original attack; in most cases six grains are given followed by a ten days' course of pulv. ipecac. in doses of twenty grains daily. In addition, all cases receive high bowel irrigation with normal saline solution, or in chronic cases with a weak solution of silver nitrate ($\frac{1}{8}$ grain to the ounce) delivered from a small rubber catheter. In a few resistant cases a weak solution of emetine has been used for washing out the bowel without any very definite result. The native preparation "eusof-ghool" (B. P. Ispaghula) given in the morning as a kind of porridge with milk and sugar has proved a useful demulcent in certain cases. We have had little experience of emetine-bismuthous-iodide as the drug is expensive and difficult to procure in this country. In the few cases in which we have used it, the preparation appeared to have no advantage over emetine injection.

(*b*) *Dietetic.*—As in other bowel diseases constant attention to the diet of a patient suffering from dysentery is necessary. The condition of the tongue and the information gained from a daily examination of the stools should guide one in deciding what dietary is suitable for any particular case. The case of average severity is given only milk and weak tea for the first four to five days. At the end of this, if his condition warrants it, he is put on a diet of milk or beef-tea, the former, which contains arrowroot, being preferable if the patient has diarrhœa, while the latter is more suitable for constipated individuals. From the sixth to the eighth day eggs, custard and cocoa are added to the menu. After nine to ten days the average patient can safely be fed on to a chicken diet in which macaroni replaces the vegetables normally present. After the twelfth day he is given a full chicken diet with vegetables. Stool examinations are made on three successive days: if negative the patient is now allowed ordinary dining hall diet; if positive, and more especially if blood and mucus re-appear in the stools, his diet is again reduced to milk and if necessary he is put back to bed. Normally the average patient is allowed up for two hours daily after the ninth injection of emetine; he is allowed up half a day at the end of his course and all day when he can take a full dining hall diet. After two or three days on full diet he is marked out to attend twice weekly for stool examinations. Acute and fulminating cases should receive nothing more than boiled rice or albumen water, sherry, whey, etc., during the first forty-eight hours after admission.

(*To be continued.*)

THE R.A.M.C. SERVICES OF A DIVISION ON ACTIVE SERVICE.

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Royal Army Medical Corps.

(*Continued from p.* 258.)

VII.—The Dispositions of the Field Ambulances on the Line of March.

Field Service Regulations, vol. ii, Operations, Section 28 (2), lays down the following :—

"Field ambulances, less motor ambulance vehicles, follow their own divisions unless otherwise ordered, and will usually march in rear of the ammunition columns."

The saving grace of this passage, in so far as the medical services is concerned, lies in the words "unless otherwise ordered."

The length of a division marching on one road may be taken as about fourteen miles. It follows then that if the field ambulances march together behind the division, and if some of the leading troops require urgent medical assistance and transport, there will be available only the regimental medical establishments, who have with them no transport for sick and wounded ; the nearest horsed ambulance wagon will be fourteen miles to the rear. All that can be done with a severely injured or seriously ill man who is unable to march further is to apply first-aid and fall out another man to remain with him at the side of the road until the field ambulances arrive in four or more hours' time.

Motor ambulance cars cannot possibly march with troops; their engines cannot stand the low rate of speed; in consequence, it would be no use to send a message by motor cyclist back to the field ambulance for an ambulance car to be sent forward. It is very doubtful also if the orders with regard to march discipline would permit of an ambulance car being sent forward while the troops were on the march. To send forward one of the four-horsed ambulance wagons which accompany each field ambulance is absolutely out of the question. There is nothing for it but to let the man lie by the side of the road for some hours if the field ambulances are to march at the rear of the division.

It must be remembered that casualties will occur in a division on the march as a result of attacks by hostile aircraft when there is no possibility of contact with the enemy on the ground taking place.

It is most discouraging for troops to see their wounded comrades lying about without proper attention. Everyone likes to think that if he is wounded he will be properly taken care of.

Also when the march is over it will be a long time before the sick can be collected from the regimental medical establishments of the leading brigade groups and evacuated to the casualty clearing station.

There is no doubt that the comfort of the troops and also their "morale" will be much enhanced if a field ambulance is allotted to each brigade group when the division is on the march. A field ambulance so allotted should come under the orders of the brigade group commander for billeting and for march orders.

If this is done the sick from the brigade group can be quickly collected and accommodated in a dressing station opened by the field ambulance concerned. There they can remain in comfort until orders are received from the A.D.M.S. as to their evacuation. Sick collected on the line of march by the two leading field ambulances should, normally, be sent to the third ambulance in the rear of the division for evacuation as soon as that unit has prepared accommodation for them. From there they will be transferred to the casualty clearing station by means of the cars of the motor ambulance convoy working under the orders of the D.D.M.S. Corps.

A few words are necessary with regard to the motor ambulance cars of the field ambulances. This transport cannot march with their units. The motor ambulance cars of each field ambulance, together with its three-ton lorry, should remain behind under the command of an officer until the rearmost troops of the division have passed. The motors should then advance by bounds and in this way keep in touch with the division.

The officer in charge of this motor transport must take care not to block, or be blocked by, the divisional train.

The "bounds" should be made every hour until the division halts for the night, when the motor transport of the field ambulances should proceed to rejoin their units, the location of which should have been made known to the officers in charge by their C.O.s before marching off.

If these locations should, for military or other reasons, be changed after the field ambulances have moved off, the A.D.M.S. is responsible that officers in charge of motor ambulance transport are informed of the change and as to where their units will be found on the completion of the day's march.

After the motor ambulance cars have rejoined their units they should be at once detailed for the duty of evacuating sick and wounded to the field ambulance ordered by the A.D.M.S. to receive them. They will be required again early the next day to evacuate cases which report sick before the units move off on the march and are considered unfit to accompany them.

The above system is recommended when a division is marching on one road and contact with the enemy is not expected. The alternative system of detaching horsed ambulance wagons from their units and distributing them amongst troops on the march is only mentioned here to be condemned. The transport so detached is never looked after, the horses are not properly watered and fed. When the march is over the wagons with their sick and

wounded are sent to find their units and get lost, and after wandering about for hours in the dark may eventually succeed in finding them.

Let us now consider what the dispositions of the field ambulances should be on the march when contact with the enemy is expected.

In this event it is probable that the division will advance on a two brigade front. This may be taken to mean that the division will be formed into three brigade groups, two of which will advance to the front by means of more or less parallel roads, while the third brigade group will march in rear of the two leading groups in a position from which it can support either of the leading groups, or be deployed on the right or left flank of the two brigade front, as may be necessary. Each brigade group may be assumed to be composed of an infantry brigade with a proportion of artillery and engineers. The two leading brigade groups will certainly each be preceded by a strong advanced guard, including at least one infantry battalion. It will be obvious that each of the three brigade groups should have a field ambulance attached to it. That allotted to the brigade group marching in rear of the two leading groups, should march in rear of it. A different disposition should, however, be made of the field ambulances attached to the two leading brigade groups. One half company of each field ambulance, less its transport, should be allotted to the advanced guard headquarters and the remainder of the field ambulance should march in rear of the brigade group to which it is allotted. If this be carried out, in the event of the vanguard meeting with resistance which it is unable to overcome, and the advanced guard being obliged to deploy to deal with it, the O.C. field ambulance company with the advanced guard should select a place suitable for use as an advanced dressing station, should the necessity arise. At the same time he should send forward bearers to get into touch with the regimental aid post of the battalion of the advanced guard which is deploying.

This arrangement will provide for the early collection and treatment of the wounded from the advanced guard, and provide, also, for proper medical arrangements to be brought into being at the earliest possible moment in the event of it becoming necessary for the remaining battalions of the brigade group to deploy, and to come into action with the enemy.

The motor transport of the field ambulances must, of course, when contact with the enemy is expected, keep in close touch with the field ambulances to which they belong. This will not be difficult when a division is advancing on a two brigade front moving on more or less parallel roads.

The disposal of wounded resulting from bombing attacks or from contact with the enemy's covering troops merits some attention. Such wounded should never be carried forward a yard farther than is necessary. They should be collected by the nearest field ambulance and accommodated in a suitable building where they should be left in the charge of a small detachment. Their location must be notified to the A.D.M.S., who will evacuate them by means of the motor ambulance transport of the unit providing the detachment when opportunity occurs.

The detachment in charge of the wounded should rejoin its unit after they have been cleared by means of the motor ambulance transport, which can also carry back such equipment as it may have been necessary to leave behind for the use of the wounded.

Before the late war many commanders objected to having any R.A.M.C. units on the line of march except in the rear of the division, and the arguments usually given were two: the first that they blocked the roads; the second that the ambulance wagons were conspicuous objects, and gave away the position of the troops to the enemy's scouts.

The transport of a field ambulance under proper discipline does not block a road any more than does a battery of artillery. The road space of a field ambulance, less its motor transport, is now only about 250 yards.

In these days of aeroplanes a civilized enemy will not be in much doubt as to where our troops are when marching by day. The horsed ambulance wagons—there are now four in each field ambulance—can, if they are considered to be too conspicuous, march with their tilts down, and are then little more obvious than a G.S. wagon.

VIII.—The Medical Arrangements of a Deliberate Attack in Open Warfare.

For the purpose of this section it must be imagined that the division, together with other divisions, is to attack an enemy holding a defensive position which it has had little time to fortify strongly.

The time allowed for preparation will of necessity be short, as time will enable the enemy to improve his defences.

Let us suppose that the divisional commander has formed his plan of attack and has imparted it by means of a conference to his brigade commanders, staff officers and the A.D.M.S., three days before that on which the attack will be made, and that the divisional operation orders will be published forty-eight hours before the time fixed for the attack to begin.

We will imagine that the divisional commander has decided to attack with two of his infantry brigades and to keep the third in reserve, and has defined the front on which the two brigades will attack.

The A.D.M.S., when in receipt of this information, must carefully reconnoitre the area with a view to finding sites for the advanced dressing station, walking wounded collecting station, and the main dressing station.

One field ambulance should be detailed to serve each infantry brigade, and the areas for which each is responsible, so far as the collection of the wounded is concerned, should be carefully defined.

It should not be necessary at first to form more than two advanced dressing stations, one to serve the troops of each attacking brigade. The personnel of each advanced dressing station should consist of the nursing and clerical duty personnel of the two companies of the field ambulance allotted to the area in which it will open.

The headquarters of the two field ambulances with which we are dealing

should remain in some convenient place ready to advance and open dressing stations in advance of those already established, when the success of the attack renders it necessary to do so.

The third field ambulance should be ordered to open a main dressing station with its headquarters supplemented by the nursing and clerical duty staff of its two companies, and also to provide the necessary staff for the walking wounded collecting station. The officers and the bearer personnel of its two companies should be placed in some suitable place as a reserve.

The disposition to be made of the motor ambulance transport merits detailed description. In a deliberate attack, or on the defensive in both open and position warfare, the author is strongly of opinion that the motor ambulance transport should be pooled and a divisional motor ambulance convoy formed under the command of an officer for the duty of clearing wounded from the advanced dressing stations to the main dressing station. The reason for this is that it almost invariably happens that, in open warfare at least, casualties are far more numerous in one area than in another. When this occurs, if the motor ambulances are allowed to work under the orders of their unit commanders, it will follow that the ambulance commander responsible for the clearing of the area in which the casualties are most numerous will find that he is unable with the cars at his disposal to keep his advanced dressing station clear of wounded, while very possibly the casualties are light in another area and the motor ambulance cars in that area are not being worked to their full capacity. If this is the case, the field ambulance commander responsible for the congested advanced dressing station will be obliged to send a message for help to the A.D.M.S. who, in turn, will have to detail ambulance cars from the other field ambulances to assist him, and this will result in much time being lost.

Time lost in war can rarely be recovered. To avoid this the motor ambulance cars (with the exception of two light cars to be kept for duty with the bearers of each of the field ambulances clearing the two brigade groups we have imagined to be under orders to begin the attack, one light car for service at the walking wounded collecting station, and two others for duty in clearing artillery aid-posts) should be pooled to form a divisional motor ambulance convoy.

The motor ambulance transport of a division now consists of 2 heavy and 6 light ambulance cars to each field ambulance, i.e., 6 heavy and 18 light cars. Of this number seven light cars have been detailed which leaves a total of seventeen cars for the duty of clearing the wounded from the advanced dressing stations to the main dressing station.

The A.D.M.S. should issue orders that at zero hour there should be two ambulance cars at each of the two advanced dressing stations to be opened at that hour. This disposes of four cars, leaving thirteen in hand.

Car posts, each of 3 cars, should be formed on the road or track leading from each of the 2 advanced dressing stations to the main road of evacuation to the main dressing station; the remaining 7 should be

posted at some convenient place in a rank on the main road of evacuation past which rank loaded cars must, of necessity, pass on their way to the main dressing station.

In this way, soon after the attack has begun, a regular circuit of loaded cars proceeding to the main dressing station, and of empty cars going to the advanced dressing stations, will be established.

Let us now imagine that one of the cars at the advanced dressing station distinguished on the accompanying diagram by the letter A has been loaded with wounded and moves off along the road leading to the main road of evacuation. On its way it must pass the rank of 3 cars, and as soon as it does, or is sighted, 1 of the 3 cars on the rank goes forward to the advanced dressing station to take its place. The loaded car on its way to the main dressing station must also pass the rank of seven cars posted on the main road, and should pull up for a few seconds to inform the serjeant R.A.S.C., who should be in charge of this rank of cars, as to which advanced dressing station he has come from. It is better that the designation of this advanced dressing station should be written on a card and given to the driver before he leaves, and that he should give this card to the serjeant in charge of the car rank on the main road.

A procedure such as this will prevent mistakes, and make it impossible for a driver who does not know the correct designation of the advanced dressing station to describe it in vague terms such as "The one with the two dead horses near it," or in terms as amusing as they are uninstructive.

Immediately it is known from which dressing station the loaded car has come, one of the cars in the rank must go forward to the car post formed on the road leading from the main road to the advanced dressing station to take the place of the car which went forward from this post to the dressing station when the loaded car passed on its way to the main dressing station.

The loaded car having passed the car rank on the main road proceeds to the main dressing station, where it is unloaded, and after all stretchers, equipment, etc., removed with the wounded have been replaced, it will return to the car rank ready when its turn comes to go forward to one or other of the car posts, and from thence to the advanced dressing station, and again when loaded once more back to the main dressing station.

It follows, then, that a complete circuit of cars is thus established, and that an advanced dressing station receiving the most casualties gets the most cars to clear it.

Repairs to motor ambulance cars are carried out by the supply column serving the division. The A.D.M.S. should apply through the "Q" Branch of the Divisional Staff for a repair lorry with a staff of motor mechanics to be at the car rank on the main road by zero hour. If this is done, each car returning to this car rank from the main dressing station, can be examined by the motor mechanics while it is waiting its turn to go forward, and any necessary running repairs carried out.

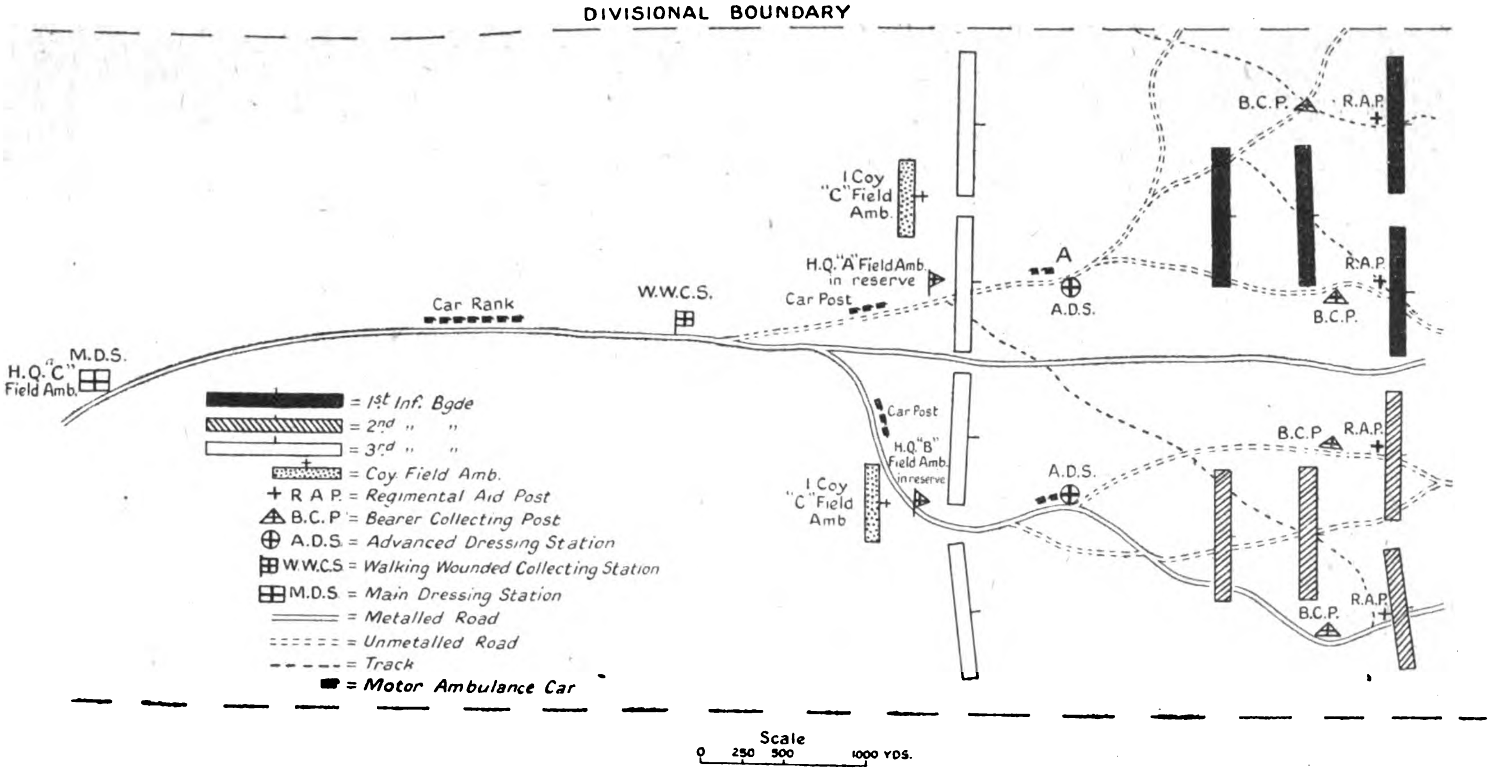

Diagram No. 1.—To illustrate Section VIII.

The roads leading to the advanced dressing station should be patrolled at frequent intervals by a motor cyclist who will report the whereabouts of any cars that may have been knocked out by the artillery fire of the enemy. The officer R.A.M.C. in command of the divisional motor ambulance convoy should make his headquarters at the car rank on the main road of evacuation, and to him all applications from field ambulance commanders for cars to meet an emergency should be sent. They should not be sent to the A.D.M.S. at divisional headquarters.

The horsed ambulance wagons, which are now four in number to each field ambulance, should be employed with the companies of the field ambulances, but those of the field ambulance whose companies are in reserve might with advantage be employed on the route which the walking wounded will take, carrying the more severely wounded to the collecting station. The necessity for having spare teams of horses at hand for these ambulance wagons must not be lost sight of.

The A.D.M.S., having made his scheme for the medical arrangements for the coming attack, must first submit it to the "G" and "A" branches of the staff for approval, and when it is approved should issue the R.A.M.C. operation orders to all concerned.

In these orders, of course, it will not be necessary, if the field ambulance commanders are war-trained, to go into much detail; the formation of the divisional motor ambulance convoy, for instance, should be a standing order, and then all that will be necessary is to state that this standing order will be acted on, the site of car posts being given.

After the attack has begun, the A.D.M.S. will not be in a position to do much more than inform his field ambulance commanders as to the situation, for which purpose he must be in the closest touch with the "G" branch, and order the movement of his reserves so as to conform with the situation. Very much must be left to the initiative of his field ambulance commanders, who should without reference to the A.D.M.S., make the necessary movements of their units to meet changed conditions. They must, however, after they have given orders for a move of importance to be carried out, at once inform tne A.D.M.S. by cyclist orderly.

The A.D.M.S. is, none the less, the officer chiefly responsible for the medical arrangements, and in the event of any real emergency he should go at once to the place where he can get personal or first-hand information with regard to it, and then having satisfied himself as to the conditions give orders as to the way it is to be met.

Diagram No. 1 illustrates the dispositions of the motor ambulance cars.

IX.—Dispositions of the Field Ambulances of a Division for Offensive Operations on a Large Scale in Position Warfare.

In the attempt to describe these dispositions it is to be imagined that we are the R.A.M.C. personnel of a division which, together with other divisions, will engage in a simultaneous attack upon an enemy who is

strongly entrenched. Our division will be entrusted with the capture of three objectives.

Diagram No. 2 shows the three objectives of this imaginary division and the positions on which the three brigades will assemble before zero hour ready for the assault.

It will be seen that the first objective consists of the enemy's first system of defence, a front line and a support line. This objective is to be captured by the first infantry brigade shown as concentrated in our front and support lines ready to pass to the assault at zero hour.

The divisional commander will, we shall suppose, have ordered the attack to be made by two battalions of this brigade, supported by the two remaining battalions.

The second objective is the enemy's second system of defence and consists of a front and support line which enclose a small village ; to the the south is a harp-shaped trench system which represents an enemy strong point.

The second objective is to be captured by the second infantry brigade which is to be concentrated in our reserve line and will, one hour after zero, leave its place of concentration, pass through the front infantry brigade in occupation of the enemy's first system of defence, and capture his second system, the second objective.

This second infantry brigade will assault the second objective in the same formation as that employed by the first infantry brigade, i.e., two battalions will make the attack closely supported by the second two battalions, one of which will, however, after the objective has been captured get as far forward as it can with reasonable safety and take up a defensive position as shown by the hachured line drawn on the diagram.

This battalion will then be in a position to break up a counter-attack coming from the enemy's third system, and to cover the consolidation of the captured second objective, and also, to a certain extent, to cover the movement of the third infantry brigade as it advances to capture the third objective which is shown on the diagram as a single line of trench.

The third infantry brigade, it will be seen from the diagram, has a considerable distance to go and has to pass through our first and second infantry brigades to get into position for its assault on the third objective. It will be seen, also, that it will have to attack on a broader front than either of the other two and that, on this account, the divisional commander will probably give it the support of the battalion of the second infantry brigade which covered the consolidation of the second objective.

We shall suppose that the third infantry brigade will receive orders to advance four hours after zero.

Offensive operations in position warfare are never carried out without very thorough preparation. The time occupied in preparing for a first class offensive can always be measured by weeks. The A.D.M.S., if the medical arrangements are to be a success, must have early warning that

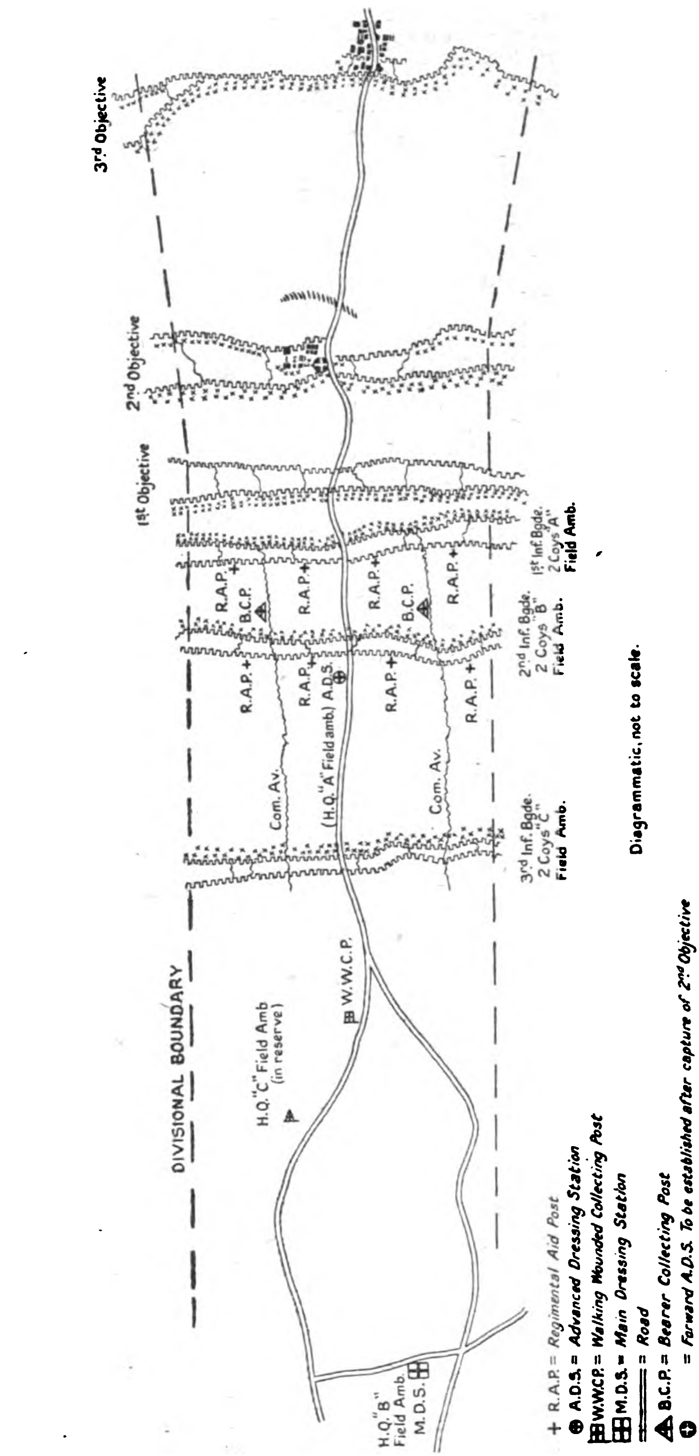

Diagram No. 2.—To illustrate Sections IX and X.

an offensive is contemplated. He should be informed by the divisional commander at a conference of divisional and brigade staffs of the objectives to be captured and the troops to be employed.

The A.D.M.S. and D.A.D.M.S. should, when in possession of this knowledge, thoroughly reconnoitre the ground, if they are not already familiar with it, and then draw up a scheme as to how the medical problem is to be solved. They should carry out this reconnaissance independently of each other.

Having drawn up his scheme the A.D.M.S. must next ascertain if it meets with the approval of the "G" and "A" branches of the staff. This is very necessary as otherwise he may find later that his whole scheme may be upset owing to the fact that the sites he requires for bearer collecting posts, advanced dressing stations, etc., are required for battalion or brigade headquarters, dumps, etc.; it must be remembered that a division only exists for the defeat of the enemy and that the needs of the fighting troops come first.

The "G" and "A" branches of the staff having approved of his scheme, the A.D.M.S. should next hold a conference of his field ambulance commanders, and after having impressed upon them the necessity for secrecy, should give them as much information with regard to the approaching operations as may be necessary, and explain to them how he proposes to deal with the problem of rapidly clearing the wounded incidental to the capture of the three objectives.

This question will be thoroughly discussed by the A.D.M.S. and his field ambulance commanders, and each officer present should have an opportunity of thoroughly understanding what is required of him, and the preparatory work which is to be done by the unit which he commands. This preparatory work which must be undertaken by the field ambulances if the medical arrangements are to be a success, will now be discussed.

The first essential is to establish a good advanced dressing station as far forward as possible on a road practicable for motor ambulance cars. In offensive operations the advanced dressing station must be as far forward as possible, and should not be more than a thousand yards from the front line provided that a road up to it practicable for motor ambulance cars exists. If a trolley line is available in the area, and it is possible to clear the wounded from the front line by means of trollies pushed by hand, it may be permissible to site the advanced dressing station farther back.

The chief difficulty with regard to the removal of stretcher cases to the advanced dressing station is, as a rule, not the fire of the enemy but the exhaustion of the stretcher bearers. To avoid this the advanced dressing station must be sited well forward. It is quite justifiable to run considerable risks, and to suffer losses, to establish an advanced dressing station in such a position.

The dressing station when completed should be capable of accommodating at least forty stretcher cases, and have a good well-lighted

dressing room in which three stretcher cases at a time can be dressed. It should be proof against the shells of the enemy's light and medium artillery.

We will imagine that our divisional front is a short one, not more than 1,200 to 1,300 yards, and in consequence one advanced dressing station will meet requirements.

The regimental aid posts are the concern of the battalion commanders but we will imagine that those of the first and second infantry brigades have been placed in the support lines of our first and second systems.

Two bearer collecting posts will be required each about half way between the front line and the advanced dressing station. These should be large steel shelters, well dug into the ground and sandbagged, and each should be capable of sheltering eight stretcher cases in the event of the necessity arising.

The positions of the advanced dressing station, the bearer collecting posts and the regimental aid posts have been shown on the accompanying diagram. The construction of these places will tax the powers of the personnel of the field ambulances very highly, but experience has shown that our men never work so well as when employed on construction work in the trenches. There is never any real necessity to apply for working parties from other units. If the work required to be done is too technical, the C.R.E. of the division should be called upon to supply N.C.O.s to supervise the work, and that is all that is required.

After the various works of preparation have been commenced the O.C. of each field ambulance should arrange for all his officers and N.C.O.s to become familiar with the line so that any one of them shall be able to go to any part of it without a guide. This applies with special force to the officers and N.C.O.s of the field ambulance companies. They should be able to find their way to any part of the trenches by day or night.

There is also a great deal of preparatory work to be done behind the line.

The O.C. of one field ambulance will have been informed that his two companies will be responsible for the formation of a forward advanced dressing station in some suitable place as soon as the second objective shall have been captured. He should then carefully consider what equipment he will require for this purpose, and bearing in mind that it will have to be hand carried, should have it neatly packed in sandbags so that when he receives orders from his headquarters to advance he will be able to do so, and to carry with him all that is required to enable an advanced dressing station to be opened as soon as he shall have decided upon a suitable site in the captured second objective.

A careful study of air photographs of the enemy's position, together with observations from the forward observation posts, will enable him to form some idea as to where this forward advanced dressing station might be placed. Nothing definite can be decided as to its site until the second objective has been captured and consolidated.

Preparations must also be made for the storing of extra dressings and splints at the regimental aid posts of the first infantry brigade so that there shall be no possibility of a battalion running short of such necessaries. All dressings intended for this purpose must be packed in sandbags so that when the time comes for the regimental aid posts to move forward they can do so, and at the same time carry a sufficiency of dressings, etc., with them.

Extra stretchers will also have to be drawn, and the transport of each field ambulance will be kept busy drawing R.E. material from the dumps and carrying it up to the line at night.

Tins for water must also be obtained and, to mention another of the very many things that have to be got ready, directing boards for the walking wounded must be prepared. There cannot be too many of these; walking wounded invariably walk in the wrong direction if there is any possibility of their doing so.

(*To be continued.*)

PROGRESSIVE ULCERATION OF THE SKIN ASSOCIATED WITH A DIPHTHEROID BACILLUS.

By Brevet Lieutenant-Colonel H. MARRIAN PERRY.
Royal Army Medical Corps.

An interesting condition of extensive and progressive ulceration of the skin has been examined and has presented such unusual features as to warrant its being placed on record as further cases of similar nature may be noted and opportunity may be afforded of comparing the results of bacteriological investigation directed to the determination of their ætiology.

The patient, a corporal in the Royal Army Medical Corps, developed symptoms of appendicitis, was operated on for that condition and a retro-cæcal abscess was opened and drained. Progress after the operation was satisfactory for a period of three weeks, when the wound looked unhealthy and exhibited a tendency to ulcerate. The ulcerative process spread rapidly despite treatment, and the affected area of skin was finally excised and the raw surface cauterized with carbolic acid. Recurrence, however, soon occurred and the condition continued to extend in spite of various forms of local treatment.

The character of this progressive ulcerative lesion was briefly as follows:—

The initial stage consisted of an intense inflammatory area of skin, bluish red in colour and markedly œdematous. At a later stage, the epithelium was destroyed in places and the lesion became carbuncular in appearance. Still later, the entire epithelial covering of the affected area underwent necrosis, and a raw surface covered with adherent slough resulted. The slough gradually separated leaving a bright red granulating surface which eventually healed with much scarring. The margins of these healed areas were irregular and serpiginous in outline. The ulcerative process continued to extend at one margin of the lesion.

This has been the sequence of events for about eighteen months, and the photographs illustrate both the advancing edge of the ulceration and the scarred areas which are left on healing. It will be noted that from its origin in the right iliac region, the process has spread widely over the thorax, has extended around the right flank and has involved a considerable area of the back.

Diagnosis.

Repeated Wassermann tests have been made with consistently negative results. A full course of anti-syphilitic treatment has caused no amelioration of the condition.

Bacteriological examination of the pus exuding from the openings in the developed lesion has resulted in the isolation of an enormous variety of organisms, *Streptococci, Staphylococci, Bacillus coli*, etc. The result of careful investigation of the inflammatory zone of skin some inches beyond the

FIG. 1.—Showing original operation scar and healed sites of ulceration on abdomen and thorax.

FIG. 2.—The active lesion extending around the right flank.

FIG. 3.—A further stage of fig. 2.

FIG. 4.—The extension of the lesion to the scapular region, showing its different zones of inflammation, sloughing, granulation and final scarring.

To illustrate "Progressive Ulceration of the Skin associated with a Diphtheroid Bacillus," by Brevet Lieutenant-Colonel H. MARRIAN PERRY, R.A.M.C.

extending edge of the ulcerated area has yielded more interesting and consistent results. The superficial epidermal scales were first removed with a sterile knife and the underlying surface cleaned with sterile swabs, small quantities of serum were then collected in sterile sharp-pointed pipettes. From this material, a pure culture of a diphtheroid bacillus was isolated on numerous occasions. This organism was also present in large numbers in films made from the serum or pus obtained in this situation, and was to be seen phagocyted in the leucocytes. From its repeated isolation, and from the fact that it was the sole organism to be found in the most active part of the lesion, it is believed that some ætiological significance must be attached to its presence.

DETAILED INVESTIGATION OF THE ORGANISM ISOLATED.

Morphology.—In films made from recent cultures the organism was characteristically diphtheroid in shape; in older cultures involution forms which assumed a swollen or clubbed appearance were common. In its staining reactions the diphtheroid was Gram-positive and displayed little tendency to polar staining.

Cultural Characters.—Growth was profuse on all media.

Blood Agar.—The colonies were raised, opaque and pinkish in colour.

Agar.—Growth was pearly white in colour and tenacious in consistence.

Gelatine.—Culture was readily obtained at 22° C., the gelatine was not liquefied.

Bio-chemical Reactions.—The table given below illustrates the fermentative activity of the organism. For purpose of comparison the fermentative properties of a strain of the Klebs-Loeffler bacillus are also given.

Sugar	Diphtheroid	Klebs-Loeffler bacillus
Lactose	—	A
Glucose	A	A
Mannite	A	—
Dulcite	—	—
Maltose	—	A
Saccharose	A	—
Galactose	A	A
Dextrin	—	A

(A = Acid and medium clotted).

ANIMAL EXPERIMENTS.

The virulence of the organism for guinea-pigs was tested. Subcutaneous inoculation of two cubic centimetres of a forty-eight hour broth culture produced a localized abscess whilst the animal survived. The organism was recovered in pure culture from the pus. A similar result followed inoculation of guinea-pigs previously immunized by injection with diphtheria anti-toxin.

Serological Tests.—Attempt was made to determine whether any serological relationship existed between the diphtheroid and the Klebs-Loeffler bacillus. The organism failed to show any evidence of agglutination when put up with sera prepared against type strains of *B. diphtheriæ*. When tested against the patient's serum, the organism showed well-marked clumping in dilution up to 1 in 250.

Histological Examination.

In order to determine the nature of the histological changes occurring in the affected tissue and to confirm the presence of the diphtheroid organism in the depth of the lesion, a small portion of tissue was removed at the most active site of the inflammatory process. The changes noted were those associated with a subacute inflammation, and consisted of congestion and dilatation of the capillaries, together with a dense zone of polynuclear leucocytes. By appropriate staining a diphtheroid organism, conforming in morphology to the diphtheroid isolated, was demonstrated in large numbers, both free in the tissue interspaces and included in polynuclear leucocytes. The histological picture at some distance from the advancing edge of the lesion was that of a newly-formed granulation tissue in which the *diphtheroid* and a long-chained *streptococcus* were visible in its superficial layers.

Summary.

Bacteriological investigation has thus resulted in the isolation of a diphtheroid organism which is assumed to have some ætiological relationship to this peculiarly chronic ulcerative process. That this interpretation has some foundation is supported by the fact that it has been possible to demonstrate a definite immunity reaction towards this organism in the patient's serum by means of the agglutination test. Further, treatment by an autogenous vaccine produced markedly beneficial results.

In connexion with the possible relationship of the diphtheroid to *B. diphtheriæ*, it is to be noted that both bio-chemical and serological tests have failed to establish any similarity between these organisms. It may also be mentioned that massive doses of diphtheria antitoxin had no influence on the progress of the lesion.

It will be remembered that chronic sores, very resistant to local treatment, were common amongst troops in Palestine and Egypt during the war [1]. These ulcers were known as "Desert" or "Veldt" sores, and the ætiological factor was found to be a strain of the Klebs-Loeffler bacillus of low virulence. The clinical course of the lesion under consideration bears no resemblance to these conditions, and the only relationship is in morphology of the diphtheroids isolated.

Search through the literature has resulted in the finding of one single case of chronic and recurrent ulceration of the skin in which a diphtheroid bacillus is assumed to have been the cause. This case is reported in the *British Journal of Dermatology and Syphilis*, March, 1920 [2], and the clinical description is very closely comparable to the case under consideration. The diphtheroid organism isolated from the advancing margin of the lesion, whilst differing from the diphtheroid described above, produced identical results on animal inoculation.

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OBSERVATIONS ON THE EFFORT SYNDROME.

By Major T. KNOWLÈS BONEY.
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The following remarks on the effort syndrome are not intended to present any detailed summary of our knowledge of this condition. Symptomatology has been almost entirely neglected, while ætiology and treatment have been dealt with very briefly. On these and other points, reference should be made to the many excellent monographs by Lewis [1] and others that have appeared on the subject during the last decade, and to which I wish to express my indebtedness. In what follows the aim has been rather to jot down a few features of this syndrome which have forced themselves upon my notice in dealing with such cases as are seen under peace-time conditions n the Army principally in their relation to service and invaliding.

During the war and shortly afterwards many thousands of soldiers exhibiting "D.A.H." were examined and reported upon, but the impression gathered from contemporary literature is that these men were to be regarded largely as a product of war conditions, though disclosed and not created thereby, and that their numbers would tend to disappear from our Army once the stress and hardship of active service were no longer operating. Whether the number of reported cases per thousand of strength was greater then than it is now I do not know, but no one will deny that they are very prevalent in our Army of to-day, and form one of the most serious causes of unfitness. For this reason "D.A.H." is worthy of the most earnest attention. If we are to have a small army it must be a fit one, and the subject is of the more importance when we remember that the recruiting standards of height and weight have been reduced, the age limit lowered, and the period of training shortened. On the other hand, the load carried by the soldier tends to increase to keep pace with the requirements of modern warfare. Small wonder that the weaklings are quickly discovered.

Apart from the association of this syndrome with infective processes as a direct concomitant, the ætiology is in the majority of cases very obscure. The toxic factor, if it exists, is not discoverable, however carefully sought. This indeed may be explained on the theory that it is no longer actively operating; that it has ceased to exist, but has left its mark in the disturbed innervation which manifests itself principally in rapid and tumultuous heart action under circumstances of unusual strain. This would account for the observed facts. In the majority of cases a careful history will reveal that some disability was present before enlistment, often dating from a severe illness in childhood. Little or no inconvenience may have been experienced beyond slight shortness of breath on exertion, but inquiry will often elicit that in consequence of this the patient did not play games and generally led a sedentary life. I think all potential recruits should be questioned on this point. In this group (Group 1) the condition is not caused but merely unmasked by the ensuing period of military training.

The group of cases (Group 2) in which a toxic factor is definitely responsible comprises most of those which arise under circumstances in which a "carry over" from civil life can be excluded, principally by reason of the length of the intervening healthy period. Acute rheumatism, pneumonia and severe influenza appear to be the diseases mostly responsible. Dental caries may play a part, but I have never seen attention to oral hygiene produce benefit, though that may be because the observation period was too short.

The remainder, comprising those cases arising during service apparently solely as a result of physical strain, are difficult of explanation. I would place their number at about twenty per cent of the total. Many of them have years of service to their credit. That physical strain alone is the responsible agent in their causation cannot be accepted as likely, and I do not think is believed by any competent observers at the present time.

Speculation on the ætiology of D.A.H. as seen in the soldier is of more than academic interest. Two practical considerations emerge from the foregoing. Firstly, more careful recruiting would enable a large number of Group 1 cases to be detected; and secondly, more careful treatment during convalescence from serious illness might be expected to diminish the number of cases falling into Group 2.

I have found the treatment of this condition most unsatisfactory. Moderate exercise, graduated if possible in healthy surroundings, is undoubtedly beneficial, and I suppose nobody now treats these patients by rest in bed. Some improvement while in hospital is the general rule. It may be that complete recovery does not take place because patients cannot well be kept in hospital long enough. That is not my experience. It seems to me that hospital treatment merely restores them to the level at which they exist in civil life. Exercise tolerance improves, but the disability is latent and the associated stigmata remain. On trying to resume duty they break down again before very long and are re-admitted.

Drugs are apparently of no benefit. The physiological enlargement which the thyroid undergoes in infective processes (often accompanied by tachycardia) and its retrogression when iodine is administered led me to try in a few cases thyroid extract and in others tincture of iodine [2]. The latter was given in water in daily increasing doses. No improvement was noted with either. This failure of drug therapy is perhaps only to be expected if acceptance be given to a view of the pathogenesis of this syndrome that has been put forward, viz., that it is essentially a disturbance of the balance in a man's nervous make-up—a disturbance of the normal antagonism between the sympathetic and parasympathetic nervous system [3].

As a result I am more than ever of opinion that in dealing with these cases invaliding is the best course to pursue when the condition is well established. This point is, however, frequently difficult to decide. One examination may suffice to detect a certain number of cases, probably the majority, some of whom may be mild and suffering no marked dis-

ability, but I have been struck by the frequency with which cases will be missed at one examination alone. It appears to be a feature of this condition that a marked degree of daily variation not uncommonly exists. A man one day giving a response to the tolerance test employed, well within moral limits, may be much below par a few days later. This appears to be particularly characteristic of early and latent types in which an early diagnosis is of such obvious advantage. It is probably an expression of the fact that the response to excercise is partly governed by psychic factors which in these people are unduly prominent and easily called into play. Their emotional control is unstable, rendering them easily depressed with low, or elated with improved exercise tolerance. A man who is anxious to get out of the Army may thus genuinely appear worse than he would were this desire not present and his improvement when A.F.B. 179 is made out should be looked upon as a physiological response to his changed mental outlook. I am sure I have seen men of this class carrying out ward fatigues cheerfully at an expenditure of energy of which they would have been incapable with their battalion. They are not malingerers, because there is no intention to feign incapacity. They simply cannot help reacting excessively, and they do so to mental as well as to physical stimuli. It is an essential characteristic of the condition.

On account of this variation principally I have now given up the practice of writing reports on suspected D.A.H. cases embodying a recommendation for invaliding based on one examination alone. Admission to hospital for a period of observation has resulted in fewer mistakes.

The frank malingerer must be very rare and I think easy of detection. One can always observe the response to a series of exercise tests, and any sustained discrepancy between a patient's statements and his performance in action must show itself. D.A.H. offers no exception to the adage that one physical sign is worth any number of symptoms.

In addition to tolerance tests the presence of associated stigmata is of great value, and I have been much struck with the frequency with which they are present. Of the two commonest of these, tremor and vasomotor instability, I believe the latter to be the more valuable, being present often in latent periods when exercise tolerance is normal. On the other hand, tremor, while of great assistance in drawing attention to the defect, is usually associated with the more advanced grades which, when examined for, are sufficiently obvious. The occurrence of these associated vasomotor phenomena is of course well known, but is not I think sufficiently borne in mind and taken advantage of [4]. I would not accept as a recruit any man with cold blue damp hands without putting him through the most searching tolerance tests preferably applied on more than one occasion. Nervous instability and vasomotor instability go hand in hand.

The real difficulty that I have experienced in dealing with D.A.H. cases lies in estimating the amount of disability which any given degree of failure to respond normally to the test entails. One man with a lowered exercise tolerance may profess his ability to carry on, while another with

the same degree of lowering may refuse to admit that he can perform any duties at all without feeling exhausted. One soon learns roughly the degree of response that indicates a critical measure of incapacity, but to fix an absolute standard appears to me to be very difficult. The psychic factor again cannot be neglected. I do not wish to imply that by allowing himself to become sufficiently despondent a man can force his discharge from the Army. But the nature of his complaint is such that he can assist this end to a degree that were otherwise impossible. A soldier anxious for his discharge of course soon understands the meaning of the tests applied to him, and the value of a positive diagnosis, and for this reason I suspect that mild cases with little or no real disability as revealed by the tests are best not labelled D.A.H. One is even tempted to withhold the diagnosis in such cases as may show while under observation improvement to an extent that will permit of their return to duty. From many points of view I think this can be justified, so bad may be the moral effect of letting a man know that he has suffered from a condition that so frequently leads to invaliding. One can always indicate in the remarks column on A.F.B. 178 the reason for the case being kept under observation; and my present feeling is that the use of this term with all that it connotes in the mind of the soldier is best avoided unless discharge be contemplated.

In deciding this question of invaliding I have frequently found it helpful to ask oneself the question, "If this man be invalided what are the prospects of his being accepted again should he present himself for examination at some future date?" Admittedly the standards for rejection and acceptance should coincide as closely as possible, bearing in mind the difficulty already mentioned of fixing a hard-and-fast standard. In doubtful cases such a viewpoint should in future be even more helpful in coming to a decision. The committee which has recently been considering the problem of the effort syndrome has formulated some useful suggestions on this point, and with the further correlation of the accumulated experience of recruiting medical officers with that of those principally concerned in invaliding much valuable information should be forthcoming and greater efficiency attained.

Considering the prevalence of this condition generally the scantiness of our knowledge concerning its causation is remarkable. The subject is by no means a dull one. It is largely because these cases are drawn from that shadowy borderland between health and disease that their study presents so many problems to the clinician which arouse his curiosity and stimulate his interest. In civil life the effort syndrome may be of little moment; in the Service it is of grave importance, and it is to military medical officers therefore that we naturally turn for further light and guidance.

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RADIOLOGY (IN ARDUIS FIDELIS).

BY MAJOR D. B. McGRIGOR, O.B.E.
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FOR several years after their first discovery, the practical application of X-rays was confined almost entirely to the medical profession. Of recent years, more and more use has been made of their application to numerous industrial and trade processes.

The production of the rays is in all cases on similar lines, but the handling of the object to be radiographed, together with the positions and procedures necessary, vary much in each particular case. Hence, it is obvious that the actual design and arrangement of the component parts of each radiological department depend upon the conceptions of its own particular specialist; in the case of the medical radiologist, they are based on a knowledge of physics, anatomy, anatomical shadows, pathology and the various clinical and dental procedures. The subject of radiology has a language of its own; the distinctive terms in this country invariably begin with radio-, while in America roentgen- is used in preference. There has been for some time considerable laxity in the use of technical terms. The non-specialist as well as the specialist officer requires a knowledge of the correct terminology. The use of such an expression as "let me have an X-ray," should be discontinued; to help this object a list of the common terms is here inserted:—

Radiology: The study and practice of X-rays and radium as applied to medical and other sciences.

Radiologist: One skilled in radiology.

Radiogram: A sensitive plate or film on which a shadow has been produced by X-rays.

Radiograph: To make a radiogram.

Radiography: The art of making radiograms.

Radiographer: One who makes radiograms.

Radio-diagnosis: A diagnosis made by means of radiograms.

Radi-ability: The property of an object to transmit X-rays.

Radio-parent and radio-parency: Offering no barrier to the X-rays.

Radio-lucent and radio-lucency: Offering slight resistance to the X-rays.

Radio-opaque: Impervious to the X-rays.

Radio-therapy: The application of X-rays and radium rays in medical and surgical treatment.

In the Army, the medical radiologist has to work under entirely different conditions from the medical radiologist in civil life; conditions that will be referred to hereafter in these articles collectively as "Military Medical Radiological." The conditions of service in the Army require the adoption of systems applicable to all military hospitals and medical units, whether at home, abroad or in the field. The same factors that govern the per-

sonnel, accommodation and equipment of the existing system of military hospitals and medical units, must necessarily apply to any special branch of the military medical machine, such as the military medical radiological department. The main function of an army on a peace footing is training for war. Any system employed and taught in peace in military hospitals must be identical with that suitable for use in war.

The personnel trained under these conditions would have such a detailed knowledge of their duties and apparatus, that they could reproduce their previous standards under the varying conditions of a radiological department in war—working in wards, in tents, in huts, or in the open. But it must be kept in view at all times that *mobility is the first principle of war organization. Any methods of instruction, any methods of technique, any methods of design and construction must fulfil this first principle.*

To accustom the radiologist and his radiographer to work under the constant conditions of a civil hospital is fatal to rapid work under the varying conditions of war. Therefore the requirements of a military medical radiological department are:—

(1) Adequate training.
(2) Mobility.
(3) Standardization.
(4) Safety first.
(5) Efficiency.
(6) Low cost.

(1) *Training.*—Personnel is changing constantly; this cannot be avoided, but by adopting better methods of standardization and definite systems of training, efficiency will be attained.

(2) *Mobility.*—(*a*) The apparatus should be made so that it can be packed in suitable weights for handling and transport. No package should weigh more than forty pounds. (*b*) The apparatus should be easy to erect and to dismantle, and should be mobile within the hospital.

(3) *Standardization.*—At present, apparatus and the fitting up of the same vary so much throughout the Service that this is not fulfilled. Unity of effort is one of the maxims of war but unity of effort will not be possible in the military medical radiological department until unity of training, design, and equipment is reached. Standardization will solve the problem of providing spare parts and replacements with economy and rapidity.

(4) *Safety First.*—In all radiological work, the highly specialized knowledge of the medical officer is essential. For the protection of the patient and the operator the findings of the X-ray and Radium Protection Committee are available in their revised report, December, 1923, which is republished in this number of the Journal. In medical radiology, however, the object to be radiographed, i.e., the patient, often requires operation or special examination, and this demands that the designer of a medical radiological department must have an intimate knowledge of ordinary and special clinical procedures, operations, and the administration of anæsthetics.

(5) *Efficiency.*—(*a*) Apparatus: This depends on the original design, and upon the conditions, local, climatic, etc., under which it may have to be worked. The apparatus selected should be that found and proved by the military *medical* radiologist *himself* to be the most satisfactory. Standardization of apparatus is intimately bound up with this question. (*b*) Department: The military medical radiological department must, as in the United States Army,[1] be recognized as a separate entity of the military medical machine.

(6) *Low Cost.*—This always must be taken as the maximum efficiency at the minimum cost, but does not mean the cheapest article, although low cost is and can be compatible with efficiency.

The following conceptions, based on these requirements, are suggested as meeting the necessities of the military medical radiological department. The first M.M.R. conception should relate to the suitable methods of generating the high-tension current, but this is of necessity left over until a later date, as the various types of apparatus are under review by the War Office Committee at the present time.

First Conception: High-tension Leads.

The following system of high-tension leads has been designed primarily as suitable for military hospitals at home, or abroad, in peace or in war. In the tropics, this system is specially advantageous in view of the extreme height of the roofs, the presence of ceiling cloths, fans, punkahs, etc. The system would be equally efficient in civil hospitals, but the military medical radiological requirements do not apply, hence more elaborate fixed types are permissible.

Fig. 1 shows a transformer set and fig. 2 a coil-set in elevation with the position of the wooden gallows supports and the fixed rigid half-inch brass rods, each supported on two short vulcanite stems. From the ends of these brass rods coronaless rheophores carry the current to the X-ray tubes above or below the table; the details of the above- or below-table holders are omitted as anyone can easily erect them. In order to minimize the length and angle of the coronaless rheophore wires, the table remains freely movable and the X-ray tube stand need never be moved along the table, as the patient can be placed head or feet towards the generator according to the part requiring examination. On the ends of the high-tension rods, brass balls are soldered, and if Coolidge tubes are to be used a piece of cab tyre flex can be run inside the negative rod to carry the second wire from the filament heater to a suitable terminal. In the latter case, it would be useful to have the ends of the negative rod finished in the female half of a screw type lampholder, or similar device, instead of a brass ball in order to take the male half of the lampholder, etc., attached to the double rheophore; a good contact would thus be made. The screw or plug

[1] *Vide* "X-ray Manual," Special Division of Roentgenology, United States Army.

type is better than the bayonet catch for this contact, as with four or five amperes passing through the filament heater, simple contacts are not satisfactory.

In place of the two central brass balls shown on each rod in the figs. 1 and 2, the short vulcanite supports might be made heavier and square, and have holes the exact size of the brass rods drilled therein; this would function better, as the rods would not only be well insulated, but fixed without any soldering at all. If occasion demanded, the rods could be moved a little towards either the table end or the upright screening end, or one rod alone could be moved as shown in fig. 3 where the lay-

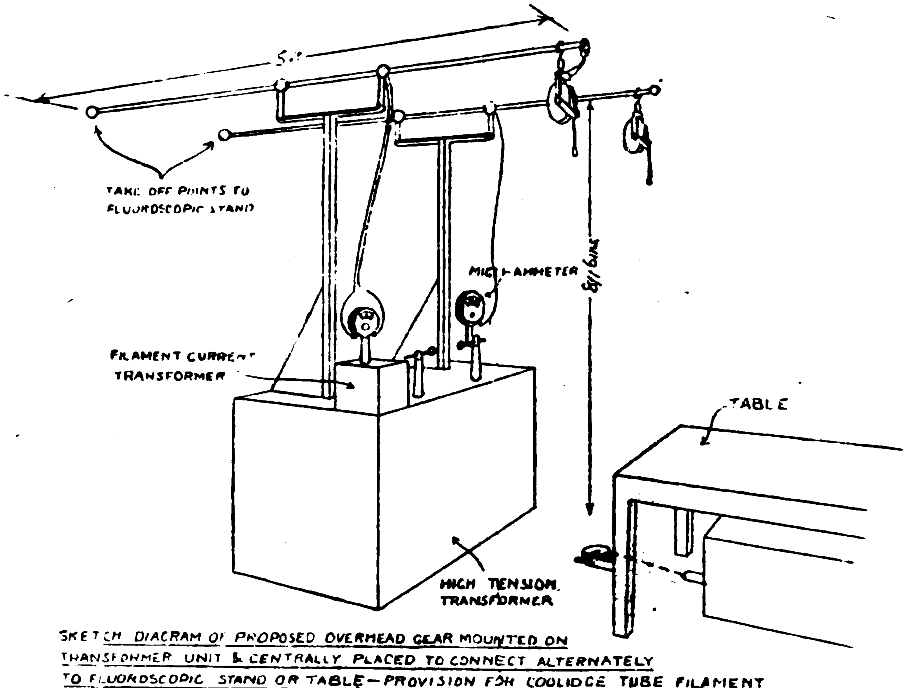


Fig. 1.

out of the room at right angles would be more suitable than all the apparatus in a line. The cost of this system is very small and is about one quarter that of the regular civil hospital system of "fixed to the roof" overhead rods, and it is within the scope of any *practical* radiologist or radiographer to erect these anywhere.

The following is an estimate for erecting this type :—

"The estimated cost of this type is £3. It consists of 2 inches by 2 inches deal fillet, framed together to form carriers, fixed at the base with 14 S.W.G. sheet iron brackets; the brackets are screwed to the fillet, and held in position with dowel and thumb screws. Ebonite supports, 2 inches by $\frac{3}{4}$ inch by 6 inches long, are fixed to the ends of the fillets to

carry the ½ inch brass tubes; the tubes are fitted at the ends with brass balls 1½ inches in diameter. A stretcher of two inches by one inch deal, fitted with light sheet iron angle plates and fixed with thumb screws is required to keep the carrier rigid. Should the height of the carrier exceed five feet, the fixing at the base would need stiffening at a small increased cost."

This system has been tried at the Queen Alexandra Military Hospital, Millbank, and found in every way safe and efficient.

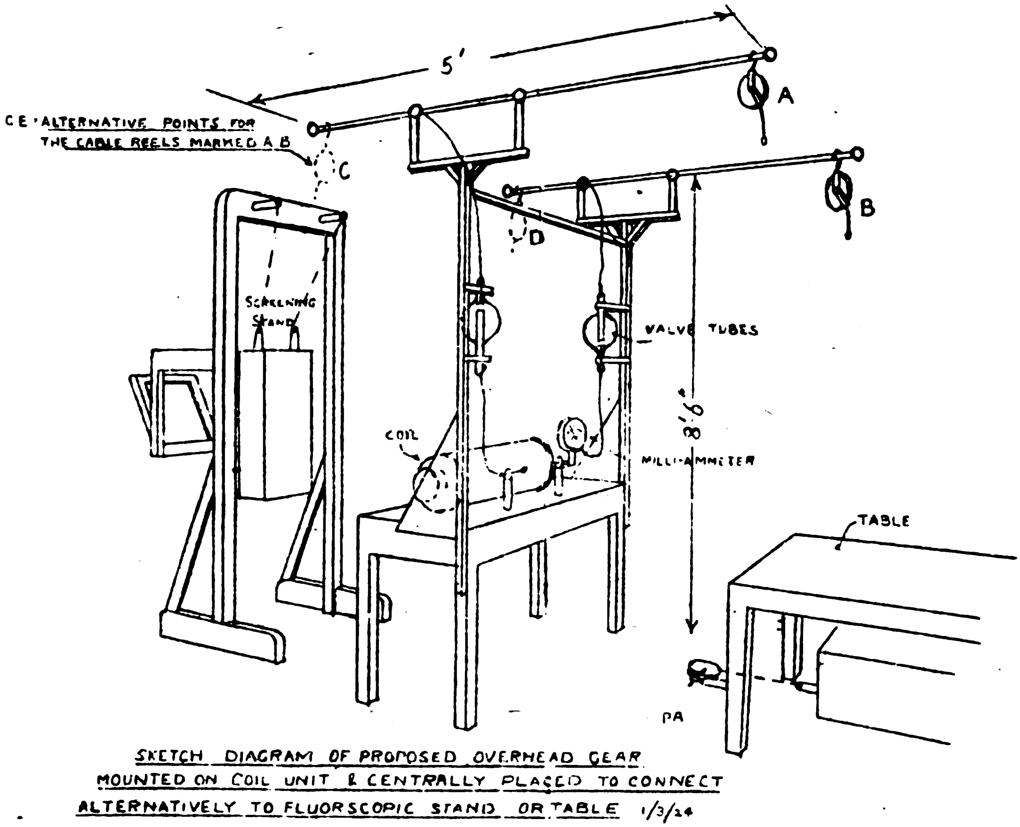


Fig. 2.

Fig. 3 shows the plan of the transformer room at the above hospital. Special attention is drawn to the free area at the distal end of the table for the anæsthetist, who is frequently present during a radiological examination in such cases as pyelography, setting of difficult fractures, and extraction of difficult foreign bodies, etc. In such cases I consider it essential, especially when giving ether in a closed dark room, to have the anæsthetist as far from any high-tension rods or wires as possible and to have any additional suction fans, etc., behind the anæsthetist's area. The position of the control operator behind his lead screen is satisfactory for any work and with one pair of rheophores no two pieces of apparatus can be live with

high-tension current at the same time. With this wooden gallows arrangement very safe and satisfactory fixation or replacement of valve tubes, oscilloscopes, milliampermeters, etc., can be made, and a good cab tyre flex is as good as anything for this rigid upright arrangement. The whole "live" part of the apparatus is well out of reach of anyone in the room. The apparatus, likewise, can be moved away from any adjoining overhead electric lamps as the proximity of high-tension currents is disastrous to the filaments thereof, although the risk of this sequel can be guarded against by placing a small coil of thin wire round the lamp globes. There is absolutely no danger area round the apparatus, as no live wires are in any proximity to either operator or patient.

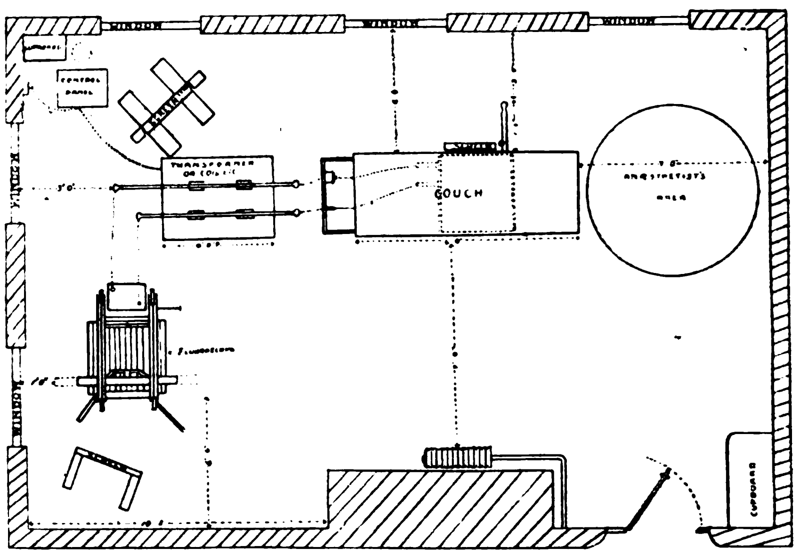


FIG. 3.

SECOND CONCEPTION: THE COUCH.

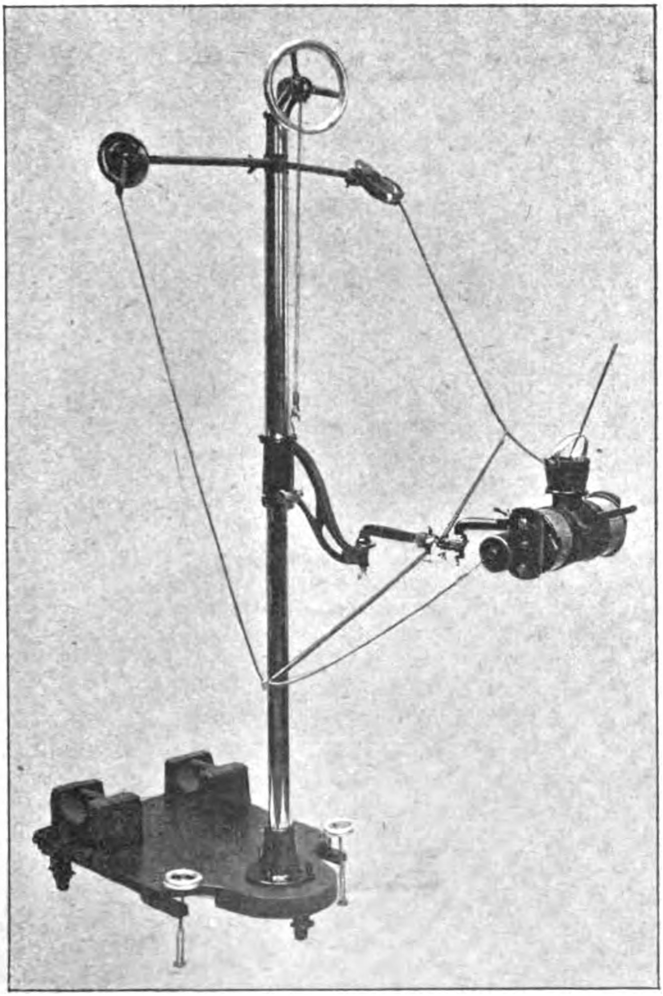
The following short note complies with the six M.M.R. requirements applied to the table :—

A plain three-ply table top, about 6 feet by 3 feet, on four legs with good castors, without any metallic or other attachments is all that is needed, as with a good tube-stand a complicated table is unnecessary. In the late war this lesson was learnt, and a stretcher on iron trestles frequently fulfilled all requirements.

THIRD CONCEPTION: THE PORTABLE TUBE STAND.

In the late war no tube stand fulfilled the M.M.R. requirements, and the following recently devised type approximates so far as possible to these conditions. No single part of the tube stand weighs over forty pounds. The weights for the base of the stand consist of the generating

apparatus or accumulators. The essential here is adaptability in order that the stand may be used easily under the varying conditions at the bedside of a helpless patient. The stand is rigid, adaptable for over or under-table work, and allows for a wide range of movement for routine work, dental radiography, or general fluoroscopic work. The necessary arrangement for stereoscopic work is likewise provided.



The design is such that no metal arm projects behind the tube stand to get in the way of high-tension wires, when the tube-holder is moved nearer the upright. The cost is low, especially if made in considerable numbers; the present estimate is £40. The cost should be considered along with the low cost of the couch as the two pieces are inseparable. The stand can be

taken from ward to ward, as required for those cases who are too ill to be moved to the radiological department.

The design is based on the movements of the human body, using the trunk as the upright, the arm—with "elbow" bending either way—as the extension, and the hand as the tube-holder. The stand consists of an upright nickel-plated steel tube, with a horizontal jointed arm and protective shield; the arm and shield are balanced by a counter-weight working inside the steel tube stand. The adjustments in a vertical plane are made by means of a hand wheel. The steel pillar is secured by means of a robust flange to a substantial flat base, having a free area approximately nineteen inches by sixteen inches, upon which a coil or accumulator, etc., can be placed and used as the base weights. The whole base is mounted on substantial castors, permitting it to be moved easily; a locking device or screw is fixed therein to keep it steady when once in position. The tube-carrying arm consists of a main body girder casting, provided with a substantial elbow-joint, permitting the tube shield to be placed where required, either below or above the table. It also allows a rotary movement on the horizontal plane which is especially convenient in fluoroscopic under-table examinations.

The protective shield is a specially constructed cylindrical type for holding ten or thirty milliampere radiator Coolidge tubes, the protection afforded having a lead equivalent to two m.m. This shield is mounted in a pair of ring supports enabling the tube to be rotated about its long axis, and is further provided with an angular adjustment working in a horizontal plane. These two movements together thus permit the beam of rays issuing from the tube to be set at any required angle or direction. The shield is provided with a cylindrical diaphragm, and an anode finder is fitted to the sides of the shield.

An adjustment for stereoscopic radiography is also provided on the horizontal arm with the stereoscopic movement either across or with the table. The stand further includes a spreader at the top of the stand with a pair of cab tyre cables going down to the coil high-tension terminals on the base. The spreader itself is provided with a pair of coronaless rheophores for making the connexions to the X-ray tube. The leads are kept clear of the metallic arms by means of two single adjustable smaller spreaders.

The photograph shows the first finished sample of the new design.

In the designing and construction of this tube stand, I gratefully acknowledge the great help given me by Mr. E. E. Burnside, of Messrs. Newton and Wright, who placed the resources of their electrical engineering department at my disposal.

(*To be continued.*)

A BRIEF HISTORY OF THE INTERALLIED SANITARY COMMISSIONS IN TURKEY, ABSTRACTED FROM THE ANNUAL REPORT OF THE SANITARY COMMISSIONER, CONSTANTINOPLE, FOR THE YEAR 1922.

By Captain R. McKINLAY.
Royal Army Medical Corps.
Late Allied Sanitary Commissioner.

There were, during the year under review, two Allied Sanitary Commissions:—

(1) The Interallied Urban Sanitary Commission, of which the D.D.M.S. was President and on which I was the executive officer from June 1, on which date I assumed the duties of Allied Sanitary Commissioner. This Commission interested itself in affairs affecting the public health of the town, such as communicable diseases of all kinds and epidemiology, cleanliness of the streets, drainage, sale of foodstuffs, narcotic drugs, etc., registration of doctors, pharmacists and druggists, water supplies, and all such questions as would interest a medical officer of health in England.

(2) The Interallied Maritime Sanitary Commission, or to give it its proper designation, *La Commission Sanitaire Interalliée Maritime et des Frontières*, under the Presidency of the French Director of Medical Services, on which Commission I represented the British Army. Its functions were concerned chiefly with the prevention of the importation of infectious diseases from outside into Constantinople or westwards into Europe.

It will be easily seen that the work of the two Commissions was largely interconnected, and that much of my work as executive officer originated from the Maritime Commission and the various controls put into force by it.

There were two sanitary controls for shipping under this Commission throughout the year, one at Kavak, where there is a Turkish Lazaret and disinfecting station; it is situated inside the northern entrance to the Bosphorus on the Asiatic side, and controls all ships coming into the Bosphorus from Russian and Black Sea ports. The other is situated at Chanak at the entrance to the Dardanelles, and deals with vessels desiring to enter the port of Constantinople from the Ægean Sea.

At each of these two places, in addition to the Turkish staff, there was one Allied Medical Officer, found in turn for a period of two months at a a time by the French, Italians and ourselves; these officers worked under the Maritime Commission and were responsible to it; they visited all ships and gave pratique or otherwise, according to the conditions on board.

Civil Administration of the Town.

As this is a somewhat complex and ponderous organization, perhaps a short description of it would not be out of place.

It was partly Municipal and partly Governmental with considerable overlapping, and as both Municipality and Government were in a state of bankruptcy during the year, it was only by continual driving and supervision that a moderate degree of efficiency could be maintained.

The municipal services deal with the general sanitary services of the town, street cleaning, municipal hospitals, attendance on the poor, public vaccinations, burial certificates, inspection of butchers' shops and bakeries, etc., and also with infectious disease, except plague, cholera, smallpox, typhus and relapsing fever; these latter were under the *Service de Santé Publique Ottomane*, a Government control known as the "Infectious Disease Department." The Government also controls the Venereal Disease Department, the Bacteriological and Analytical Laboratories, the Anti-Rabic and Vaccine Departments, the Lunatic Asylum and one hospital, the Children's Hospital. Both these administrations worked under the Interallied Urban Sanitary Commission until October, when the Angora Government assumed office in Constantinople.

How necessary it was that we should assume control of these services was immediately apparent on the arrival of the Allied Armies in Constantinople at the end of 1918; the condition of the streets at that time required to be seen to be believed; there were dumps of refuse of all sorts in side streets and on waste areas which must have been the accumulation of years; and it required a full year's work with a greatly augmented staff before these were removed.

It took still longer to make the extremely undisciplined public realize that the most simple and elementary sanitary laws must be obeyed. Such things as refuse boxes were practically unknown; householders disposed of all their refuse by the simple expedient of throwing it into the street. Fines for this offence were for a long time a fruitful source of revenue to the Allied Police, until gradually the public came to realize that although causing a little more trouble, it was cheaper and more sanitary to keep a refuse box for the municipal dustman to empty. All the other ordinary rules of hygiene were honoured in much the same way.

I remember well the difficulty with the Greek populace when the Sanitary Commission decided that the practice of removing a corpse for burial in an open coffin through the streets was unnecessary and undesirable, even although the deceased had died of a non-infectious disease. They were quite willing to admit that in the case of death from smallpox, for example, it should not be done. However, with the co-operation of the Greek Patriarch this time-honoured custom (originated, I believe, by the Turks to prevent the smuggling of arms from place to place) fell into disuse, and now it is never seen.

Amongst the local medical men who assisted the Commission there were a few genuine workers who did not seem to be impregnated with the Oriental lethargy which appeared to have completely overcome the others. On the other hand, it must be remembered that Turkish doctors were supposed

to be working for a monthly pittance (often paid months in arrears) which was not equal to the weekly wages of many miners or skilled mechanics in England; hence there was no incentive to work, and their invariable custom was to sit in their offices, smoke innumerable cigarettes and drink innumerable cups of coffee, but when they realized that we really took a genuine interest in their work and their welfare, and that intrigue of any sort was not countenanced, there was a marked improvement and a desire on the part of many to "play the game."

When we had finally gained their confidence they would bring their difficulties, professional and not infrequently private, for advice or assistance.

I have had several interviews with his Excellency the Prefect, which, when one comes to look back on them now, were somewhat amusing. These interviews were usually with the object of keeping the peace between the Prefect and the director of the street cleaning department. After the usual coffee and cigarettes and considerable talk about various matters having nothing to do with the subject, I would say that I had reason to believe that things were not going quite smoothly and efficiently, and that I could not have my work interfered with. Later, we always parted, outwardly at least, on the best of terms, and all went well again for a bit. But when it came to a question of, for example, a threatened strike of workers, it was necessary to appeal immediately to the General Officer Commanding-in-Chief.

With an organization and staff such as the above, it will be apparent that one could only devote one's time to matters of general importance, and primarily such as affected the health and safety of the Allied Armies, giving any time after that to the more minor matters, such as visiting shops and restaurants.

General Sanitary Conditions of the Town.

For a city which is the capital of a nation professing to be civilized, the general sanitary arrangements are deplorable and antiquated. What should be one of the best-drained cities in Europe, is probably one of the worst, although it has every natural advantage in site, having the Golden Horn flowing through it, dividing Pera and Stamboul, and the Bosphorus separating the European and Asiatic shores.

The drainage system is crude and quite indequate. There are many areas of the city with no drainage at all, just a series of soakage pits, always overflowing, so that one was continually the recipient of complaints from those living in the neighbourhood that their house and surroundings were insanitary. By bringing pressure to bear on the municipal authorities, conditions were temporarily put right, but had it not been for such pressure nothing would probably have been done for months, if then.

I have been in numerous houses in Constantinople where the sewers were completely broken, and fæcal and sewage matter was pouring down the walls or percolating through them; in these cases one was called on

to judge whether the landlord or the tenant was to put things right. A definite time was then given for repairs, and if they were not carried out to time the Allied Police took the matter up. I may say that it was very seldom necessary to call in police assistance, the threat as a rule being sufficient.

In those cases where drains do exist, they are poor, and do not form a drainage system at all in the European sense, consisting merely of brick or earth channels covered with flagstones, or occasionally of thin cement pipes laid so near the surface that they are continually being broken into by street traffic.

In none of the native houses, and only in some of the European houses are the latrines "trapped," so that even in some of the best houses, on entry, one is met by an intolerable odour, apparently not noticeable to the inhabitants.

The streets, however, bad as the surface is, have been kept surprisingly clean, in spite of the fact that the workers are usually two months or more in arrears of pay, in consequence of which they have threatened to strike on several occasions. When this has happened, the matter has immediately been represented to the General Officer Commanding-in-Chief, Allied Forces, as mentioned before, who always took the most sympathetic view of such a situation, and as a result of the pressure brought to bear by him on the Turkish Authorities, the unfortunate workers received some of the pay owing to them. But though it has always been a hand-to-mouth existence, the results obtained in the circumstances have been most gratifying.

Water Supply.

The water supply is derived from three sources and is inadequate especially during the summer months:—

(1) The Derkos supply is derived from Lake Derkos, some twenty miles distant from the town. It is owned by a French company, and although by far the best supply, is contaminated and insufficient. During the summer *Bacillus coli* was found present in 0·5 cubic centimetre. No filters are employed, and the whole system requires thorough overhaul and renewal; it has never recovered from the lack of attention during the war, and for the moment the Company has no money to spend on it.

(2) The Evkaf supply originates in a series of artificial reservoirs in Belgrade Forest, controlled by the Evkaf Ministry (Ministry of Pious Foundations). In this case also the supply is unfiltered, and the whole system, reservoirs and conduits alike, are in a deplorable state of disrepair. Analysis of this water showed *B. coli* present in less than 0·5 cubic centimetre.

In one area in Stamboul in the course of about one mile, there were over sixty openings into the main conduit, through which all and sundry drew their water by the simple method of dipping into the conduit. Here again, no repairs have been carried out through lack of funds, although in

this case I was inclined to doubt the veracity of the statement, as the Evkaf Ministry is looked upon as one of the wealthiest and most influential in Turkey.

(3) Wells exist all over the town; the quality of the water from these may easily be imagined.

CHOLERA.

Although cholera has been either endemic or epidemic in South Russia throughout the year, not one case occurred in Constantinople, and I am convinced that this was entirely due to the control over those coming in exerted by the Maritime Commission. And although this caused a great deal of work for those concerned, and much inconvenience for maritime passengers, the result was nothing short of marvellous. Had cholera got a hold in Constantinople under the sanitary conditions described, there is no knowing how it would have ended.

The system adopted was to obtain a specimen of fæces from each person arriving from an infected port. This was examined in the laboratory of the Maritime Administration. Up to the end of September, 11,179 such examinations had been carried out, with the result that seventeen cholera carriers and ten carriers of a non-agglutinating vibrio were isolated. As soon as this procedure had been carried out, and all on board, including the crew, had been inoculated, the passports were taken away from the passengers and they were given instead a slip ordering them to report daily for observation for five days at my office, after which time, if they had no symptoms, I returned their passports. Failure to comply with this order was punishable by the Allied Police.

As a rule the results of the examinations were available before the passengers had got down to Galata from Kavak, so that carriers were actually isolated in hospital before getting into town; in two or three instances, however, when this did not happen, it was merely a matter of a few hours until they were discovered.

In addition to these precautions affecting the town itself, it was my duty to ensure that no passengers travelled westwards until they had completed their observation period or had been pronounced as non-infective. This often gave rise to difficult incidents. For example, if the American, Swedish, Danish, or some other legation not of the Allies demanded the passport of one of their nationals, in order that he or she might leave Constantinople, it was necessary to explain, often at some length, why such restrictions were imposed, and that really the liberty of the subject was not being seriously interfered with, etc. On the whole I must say that with give and take on both sides, everything passed off amicably.

In addition to the cholera carriers referred to above, twenty-three cases of cholera were actually removed from ships at Kavak.

It is worthy of mention that those passengers from whom the non-agglutinating vibrio were isolated all came from places where cholera was actually epidemic.

Up till September 30, 18,018 cholera inoculations had been carried out at Kavak; during the same period 4,518 inoculations were performed in the town amongst people working in the docks and on the Golden Horn.

Plague.

There have been only twenty-nine cases of plague, with ten deaths during the past year; this low incidence is I think very satisfactory, considering the geographical situation of Constantinople, forming as it does one of the most important gateways on the world's international commercial highways, with ships continually arriving from east and west, and from ports where plague is endemic.

The only fact worthy of mention with reference to plague is that, as in previous years, no infected rats have been found, although upwards of 200 have been examined. This is somewhat difficult to account for, and the only explanation I can offer is, that the local population, always strong believers in fate, consider that with so few cases their chances of getting the disease are very remote. If they do get it, it is "kismet," and therefore comes in the natural course of events. Consequently, if a dead rat is found which might prove positive, it is hurriedly hidden out of the way in order that they may escape the inconvenience and restrictions of vigorous quarantine and disinfection measures.

I am absolutely convinced, however, that plague is endemic amongst the rats in one or two areas, as although there have been only sporadic cases, the majority of them, all of which were bubonic, have occurred in two well circumscribed areas. No cases occurred on the Asiatic side, although in 1920 there was an outbreak at Haidar Pasha amongst repatriated prisoners of war in the Selimlieh barracks. This is the largest building of its kind in the world, and capable of housing, according to the Turks, 20,000 troops. In this case infected rats were actually found.

During the year 107,676 inoculations against plague were carried out.

Typhus.

At no time throughout the year did typhus assume any alarming proportions, the average being 4·5 cases per week, and the maximum in any one week being twenty-two. Considering the overcrowded condition of the town, teeming as it was with refugees in a semi-starving and filthy condition, this must be considered as satisfactory.

The following are the figures for this disease during the past seven years:—

	Constantinople		Provinces	
	Cases	Deaths	Cases	Deaths
1916	1,384	198	29,264	6,989
1917	7,384	791	25,652	4,112
1918	5,580	938	6,194	606
1919	1,643	331		
1920	665	30 (?)		
1921	379	16 (?)		
1922	238	9		

The inferences to be drawn from these figures are interesting. I understand that during the war the German Medical Authorities interested themselves largely in this question, in fact, the only really good baths in Constantinople were the result of German enterprise. They certainly appear to emphasize the apparent helplessness of the Turkish authorities to cope with anything like an epidemic, especially in war time. The figures for the provinces must represent a large number of military cases, and doubtless in the Army bathing facilities did not exist.

Relapsing Fever.

Only sixty-eight cases occurred during the year under review; from the figures shown below it will be seen that this is a large decrease when compared with previous years.

		Cases		Deaths
1919	..	1,643	..	331
1920	..	665	..	30
1921	..	573	..	16
1922	..	68	..	2

Smallpox.

This disease is, and always has been, endemic with periods of epidemicity. During the year there was a total of 704 cases, of which 342 occurred in the last month. Vaccination is compulsory and gratuitous in Turkey, but nevertheless there is a very high percentage of unvaccinated persons. The ignorance of the populace on the question of smallpox is surprising, and I am credibly informed that many, after compulsory vaccination, deliberately go home and wash the lymph off in order to ensure that they will not be inconvenienced by "taking."

The epidemic in December, which still continues, was due to the influx of refugees from Anatolia and the Black Sea area consequent on the Turkish victories in Asia Minor. However bad the standard of vaccination is in Constantinople it is certainly much lower in the interior. Not only was there the influx of an unvaccinated population into the city where the disease was endemic, but numerous cases were brought in with them, either in the early stages of the actual disease, or more frequently during the incubation period. Compulsory vaccination before landing in the city was made obligatory for all, and now I am glad to say that although there are still far too many cases, it begins to look as if the epidemic was being got in hand.

Over 350,000 persons were vaccinated during the year. There is a really good lymph institute in Constantinople capable of producing a practically unlimited supply of calf lymph, from which I have obtained a considerable amount for the Army and Navy at various times.

Enteric Group of Fevers.

Constantinople is handicapped through lack of modern drainage, and with a heavily contaminated water supply enteric fever is endemic in

the city as it is throughout Turkey. During the months of July, August, September and October it assumed alarming proportions and caused considerable anxiety. One thousand and eighty-nine cases were *notified* during the year; I use the word *notified* as I am convinced that there were many more cases which were never heard of. Of these 1,089 cases, 840 occurred during the four months mentioned above.

Everything possible was done to combat the epidemic. The general public were warned against the danger of drinking impure water, of eating uncooked vegetables and fruit unless thoroughly washed and so on. Inoculation was pushed as far as possible, 86,154 persons being protected.

Use was made of this epidemic to try and improve the water supplies, but without success. I called on the Evkaf Minister, and although we had a long discussion over the inevitable coffee and cigarettes, nothing was ever done, lack of funds being the excuse given. His intentions were apparently excellent, for he informed me that by an extraordinary coincidence it appeared that for some time he had had a project in view which closely coincided with the suggestions for improvement which I put forward. However, we had to be content with his good intentions, and meanwhile typhoid kept on increasing.

A significant fact which threw considerable light on the inefficiency of this Ministry was that there appeared to be no one, engineer or other person, who knew anything about the water supply, and I had to call in a municipal engineer in order to have a survey of it made; this, of course, was really a highly irregular proceeding, as previously none of the municipal staff had ever dared approach such an important body as the Evkaf, nor did that body ever brook any interference or control from the *Service de Santé Publique Ottomane.*

Tuberculosis.

Owing to the misery and privations caused by the Great War, this disease, always one of the scourges of Turkey, gained a still stronger hold. In Constantinople alone, it was responsible for some 2,800 deaths in each year before the war, the figures rising to approximately 3,500 throughout the course of the war. There has been some improvement since, and last year the total mortality for the town was 2,231. There is a much higher incidence amongst women than amongst men, due to the unhealthy, indoor, and secluded life which they are forced to lead.

The unhygienic houses, in which open windows are unknown, and which are mostly heated during the cold weather with "mangals" (charcoal pans), the defective nutrition, the lack of healthy exercise, and the absence of any sort of sanatorium or institute for its treatment, are all predisposing factors in the dissemination of this malady.

Until the population learn something of the ordinary rules of health, there is not likely to be any very marked decrease in the incidence of disease.

Venereal Disease.

Probably in no other city in the world are the morals so lax, or is prostitution practised to so great an extent, both openly and clandestinely, as in Constantinople.

The Turkish laws on prostitution are excellent on paper, but are not carried out. According to law all prostitutes must register with the police, giving their address. They are then given an identity card, and are supposed to report weekly to the nearest dispensary for examination, after which examination the card is marked "clean" or otherwise. Should a woman be proved to be suffering from venereal disease she is immediately sent to the Venereal Hospital.

There are approximately 2,500 registered prostitutes in Constantinople, but this number represents only a fraction of the total; various estimates put the real number at about 20,000 which, in my opinion, is much more nearly correct.

The term "rabbit warren" best describes the brothel area in Galata. Here are found the lowest types of women of all nations, who grant their favours indiscriminately to the lowest dregs of the local population or anyone else who comes along for so low a sum as ten piastres (about threepence).

From the above description it will be evident why venereal disease, together with malaria and tubercle (as mentioned above), are known as the three scourges of Turkey.

Venereal disease is not by any means confined to the town, it is rampant also in the country districts.

The Turkish authorities state that venereal disease, especially syphilis, was imported into Turkey after the Turko-Russian war. It doubtless increased from this time, but it certainly originated much earlier.

In the summer of 1920, the venereal hospital for women was burnt down, and temporary accommodation for their treatment was not found until about August, 1921. I remember visiting this temporary hospital in September, 1921, and a more inefficient institution I have never seen. Method and system there was none. All the equipment had been burnt in the fire at the hospital, and there was no money to replace it. The lavage room was more like one of Heath Robinson's humorous sketches than anything else. Picture a large room with from seventy to 100 women, all chattering like monkeys, with three tables on which three doctors carried out treatment and examinations, while all present looked on. At one end of the room imagine two ordinary wooden tables, each with a patient receiving lavage from two Turkish nurses. Placed just behind these two was a third table, on which was erected a crude wooden framework; on top of this was a large douche can. A chair was also perched on this third table, and standing on this chair was a little nigger girl with black fuzzy hair tied with a brilliant red bow, solemnly ladling potassium permanganate solution with a soup ladle out of a bucket into the douche can.

Such was the lavage room, and the rest of the hospital was on the same standard ; in spite of the seriousness of it all, it was extremely difficult not to smile.

Venereal disease had always caused a serious wastage in the Allied Armies, and in September, 1921, the General Officer Commanding-in-Chief, Allied Forces of Occupation, called a meeting of the Allied Generals, and appointed a Committee known as the *Commission Interalliée de Prophylaxie Anti-Vénérienne* under the Presidency of Le Médecin Principal de Première Classe Dejouany, who was the French Director of Medical Services.

On this Committee the British representatives were the Interallied Sanitary Commissioner, the Assistant Provost-Marshal, and an officer of the Allied Police. An intensive campaign against moral offences was inaugurated. All women found soliciting, who were unregistered, or who gave venereal disease to Allied soldiers, were vigorously harried and punished. When women were arrested for such offences they were sent, in the first instance, to the Turkish dispensary for examination. If infected, they were punished and sent to hospital: if clean, they were fined, and if unable to pay a fine, were imprisoned. Over 750 such cases were dealt with by the Allied Police during 1922, the majority being from the Pera sector of the city. A separate account was opened for the money received in the shape of fines for these offences.

The Committee also interested itself in the question of providing a venereal hospital for women, with the result that a building which had been occupied by the Indian General Hospital was handed over to the Turkish Medical Authorities for the purpose. The Allied Armies equipped this hospital, and it was placed under the control of the Sanitary Commissioner with a Turkish staff.

Soon there was a really good hospital functioning, with discipline amongst the patients and a standard of cleanliness never before obtained. In one block there was a prison where those under sentence, or who broke hospital rules, were confined. In spite of our supervision, however, I realized when I took over the appointment of Allied Sanitary Commissioner in June, 1922, that the chief doctor was not all that he ought to be; in fact, there was strong reason to believe that he was accepting bribes to release patients before they were cured. Also it was almost certain that some of the more attractive women were being kept in hospital after being cured, for the amusement of the staff. In consequence of this, I had the doctor in charge replaced by another from the Venereal Disease Department who had worked for some years in Paris. Since that time the hospital has improved beyond recognition, and is now one of the really efficient organizations in Constantinople. The doctors were paid twenty to twenty-five Turkish pounds per month from the Allied Venereal Account in addition to the inadequate salary which they received from the Turkish Government; this was very much appreciated and made them keen to work and contented.

Previous to July, 1922, all Wassermann reactions and other examinations were carried out at the Government Bacteriological Institute. This was extremely inconvenient, so a laboratory, where all the bacteriological work of the hospital could be carried out, was established within the building.

The standard of cure laid down was three negative smears at intervals of two days for gonorrhœa cases before they were sent to the chief doctor for discharge. Patients sent up for discharge were seen twice a week by him, and it was the routine procedure for him personally to take a further slide from each case. Each patient was given a number on admission, and at the time when the last slide was taken, the number only and not the name was entered on it. All final slides were then examined, and if negative, the patients were discharged.

After discharge from hospital, women not already registered were given their registration cards by the police, and all were supervised weekly in the dispensaries outside, of which there are four, which it was my duty to visit.

Some 3,500 women, including the following nationalities, Turks, Greeks, Armenians, Jews, Russians, Austrians, Roumanians, Serbians, Italians, French, Americans, were treated during the year 1922.

In March, 1922, on the suggestion of Colonel Dejouany, two allied "blue lamp" rooms, or as the French prefer to call them, *cabines prophylactiques*, were opened, one in Pera and one in Galata. A Russian medical student was placed in charge of each, and I consider that they did most useful work. In the Pera room alone there were 5,055 attendances by British soldiers out of a total of 9,872 of all nationalities.

The measures adopted in these rooms were the following: After thorough washing of the external genitals with warm water and medicated soap, the attendant instilled six or seven drops of a twenty per cent solution of argyrol in glycerine into the urethra, and afterwards rubbed in calomel cream on the glans and prepuce.

The formula for the argyrol solution was the following:—

Glycerine	... ...	20 grammes
Distilled water	... ..	80 ,,

Argyrol was then added to make a solution of the strength of one gramme of argyrol to four grammes of the glycerine and distilled water.

Malaria.

Mosquitoes abound in Constantinople during the summer months, but as in the town they are all of the culex variety, there is no primary malaria in the city itself. In the surrounding districts, however, anopheline mosquitoes are found.

Throughout Turkey the rural population suffers heavily from malaria, and practically the only regions exempt are the higher plateaux in Asia Minor, but even these are not all entirely free. Lakes Ilghim and Bey-Chehir in the Vilayet of Konia all harbour mosquitoes, in what *was* other-

wise an immune area. Because of a badly planned irrigation scheme for the plain, Konia itself, which previously was free from malaria, is now a hotbed of the disease.

All the coast of Asia Minor in the proximity of rivers is more or less infected. The regions which suffer most are the villages of Bafra, Tarmeh, and Tchorchamba at the mouth of the river Kizil-Irmak on the Black Sea littoral, where the splenic index figure amongst the inhabitants rises as high as eighty per cent.

On the coast of the Sea of Marmora, Ismid and its surroundings, and the regions of lakes Sabandja and Iznik, are all heavily infected.

On the coast of the Ægean Sea, the mouths and tributaries of the rivers Ghediz and Meandre, and on the Mediterranean coast the rivers Seihan and Djeihan, all form a source of infection for the local population.

Refugees.

The enormous numbers of refugees who have arrived in Constantinople during the past three years have been a serious menace to the public health of the city. They have added further complications to an already difficult situation.

The first influx of Russian refugees occurred in March, 1919, after the downfall of General Denekin. The greatest invasion, however, took place in October and November of the next year, consequent on the defeat of General Wrangel's army, and the evacuation of the Crimea. Various estimates put the number of arrivals during these months at approximately 360,000.

So great were their numbers that it was quite impossible for the lazarets of the Ottoman Maritime Sanitary Administration to deal with them. These unfortunate people were therefore transferred to camps in Gallipoli and in the neighbourhood of Constantinople, practically as they arrived. In spite of all efforts to prevent it, thousands also landed in the town, or found their way thither from the camps or from the islands.

Sleeping where they could find any shelter, this vagrant population, badly clothed and unwashed, scattered vermin—often infected—to the danger of the public.

The Greek offensive in Asia Minor in the spring of 1921 caused refugees from Anatolia, both Greek and Turkish, but chiefly the latter, to seek refuge in Constantinople, thus adding a further 65,000 to an already overcrowded city. In February, 1922, about 20,000 Armenians fled from Galicia. These also came to Constantinople.

During the later months of 1922, as the result of the Turkish victories in Anatolia, there was a further inrush of refugees whose numbers must have reached 100,000. These were responsible for the smallpox epidemic, which still continues.

From the above description, the continual struggle which the Allied Sanitary Commission has had to combat epidemic diseases will be easily

understood. It also explains the large number of typhus and relapsing fever cases in 1920 and 1921. The plight of the refugees who were not permitted to land was even worse. I remember a ship of about 1,500 tons, which passed through the Straits on her way to Greece from South Russia. This ship had on board 4,500 Greek refugees (her normal complement of passengers would be about sixty). Twenty-seven cases of relapsing fever, 2 of smallpox, 7 of cholera, besides many other serious cases of non-infectious diseases, bringing the total up to 88, were landed at Kavak. While she was lying in the Bosphorus, forty-one deaths occurred, and I am informed that before she finally disembarked at a Greek island, there were more than 800 deaths on board her. These were voluntary refugees, who had paid the owners of the ship the sum of LT. 12 passage money. In the interests of humanity, I represented the case to the British Captain of the Port, and requested him to take any possible steps to stop this overcrowding of ships. He inflicted a fine of £300 sterling on the owners by way of deterrent, but this, I am afraid, was easily paid out of the profits of the voyage.

ANTI-RABIES INSTITUTE.

This is one of the most important institutes in Turkey. Rabies is endemic amongst the wolves and jackals throughout the country, causing frequent sporadic outbreaks amongst the dogs.

No licensing laws for dogs are enforced in Turkey. It is against the Koran to take life unnecessarily, and as the Turk does not see any necessity for destroying dogs they multiply exceedingly. Some years before the War there was a rabies scare, and thousands of dogs were deported to an island in the Marmora, where they had neither food nor water, and where they devoured one another, or died slowly of starvation or thirst. This did not constitute killing, and was therefore defensible.

During the months of May, June and July last year there was an outbreak of rabies in Constantinople. It was first brought to notice when a Turkish policeman, who had been bitten by a dog a month before, was brought to the institute suffering from hydrophobia. He died within thirty-six hours. After this the Allied police, on the recommendation of the Sanitary Commission, instituted an intensive campaign against stray dogs, and the municipal employees also assisted. It is estimated that between 8,000 and 9,000 dogs were destroyed in the city during these months.

The Anti-Rabies Institute has worked under great difficulties through lack of funds. I felt anything but comfortable on the first occasion I entered a large shed where about eighty to ninety dogs were under observation. There was no money with which to purchase chains, and they were tied with pieces of string or anything available. Three broke away whilst we were in the building, and I was very glad to go out again and to allow an attendant to lead out a rabid animal which I wished to see.

During the year 1922 three British officers, two other ranks and one naval rating were treated at the Institute.

From November 1, 1921, to November 1, 1922, 1,709 persons came to the institute, of whom 899 were actually treated. Treatment for the other 810 was not considered necessary.

Of the 899, 347 were treated by the original Pasteur method and 552 by Hogyes method.

The great majority of the cases came for treatment within fifteen days of being bitten, as is seen from the following figures:—

From 1— 5 days	417
,, 6—10 ,,	251
,, 11—15 ,,	95
,, 16—20 ,,	68
,, 21—25 ,,	34
,, 26—30 ,,	12
,, 31 days and over	22
	899

Four hundred and thirty-seven of these people were bitten on the upper limbs, 397 on the lower limbs, 45 on the face, and the remainder on the body.

All sorts of animals were responsible for the bites as shown in the following table:—

Dogs	767
Cats	70
Wolves	9
Horses	1
Rabbits	2
Men	5
Monkeys	2
Donkeys	4
Sheep	1
Rats	28
Fowls	4
	893

The director of the institute lays stress on the fact that all authorities appear to agree that although birds can be inoculated with rabies, they never show any clinical symptoms. He illustrates this by the case of a child who was bitten on the face by a cock and who was brought to him by the parents who wished to know whether or not treatment was necessary. He inoculated a rabbit from the brain of the bird and the rabbit died of rabies on the ninth day.

Of the 899 cases treated 130 had been bitten by animals certified as rabid by a doctor or veterinary surgeon. In 258 cases, from the history given, there was strong reason to suspect rabies; in the remaining 511 cases the animal was merely suspect on account of the disease being existent.

About 700 of the cases were from Constantinople, the others were from as great a distance as Samsoun, Trebizond and Eskicheir. The greatest number treated in any one month was 272 in June.

In considering the results of treatment for statistical purposes, the following three periods are recognized :—

(1) The actual period of treatment.

(2) The fifteen days following the last inoculation.

(3) Any time later than fifteen days after the end of treatment.

Only those cases who die in period (3) are looked upon as having been unsuccessfully treated. It is contended that full immunity is not acquired until the period (2) is over.

Eleven deaths occurred amongst the 899 cases treated. Of these, four arrived at the Institute with symptoms of rabies, four developed the disease during period (1), and three cases died of diseases other than rabies.

The average time elapsing between the bite and the development of rabies in three cases who were brought to the Institute with symptoms of the disease was 35·6 days. No history was obtainable in the fourth case.

The following particulars of the four cases who died during treatment are interesting, as they show how quickly rabies can supervene as the result of bites in the region of the head or upper extremities.

Case	Age	Animal responsible	Region bitten	Number of bites	Number of days between bite and treatment	Commencement of the disease
1	9 years	Dog ..	Right eye, nose, upper lip	5	16	13th day of treatment
2	19 ,,	Wolf..	Forehead, left cheek..	4 deep	12	16th ,, ,,
3	67 ,,	Wolf,.	Forehead	2	5	16th ,, ,,
4	3 ,,	Dog ..	Left forearm with laceration of the nerves	3	6	14th ,, ,,

In considering the necessity or otherwise of treatment, the following rules were adhered to:—

(1) If the animal died, was killed, or disappeared within twelve days of biting. Treatment indicated . . . . .

(2) If the animal was unknown. Treatment indicated . . . . .

(3) If the animal became ill but did not die during the observation period; observation was prolonged.

(4) If the animal was quite well and normal at the end of twelve days there was no hesitation in deciding that treatment was unnecessary.

(5) The absence of Negri bodies in the hippocampus major of an animal which had been killed instead of being placed under observation, was never taken as sufficient evidence on which to state that the animal in question had not been rabid. In such a case a rabbit was inoculated from the brain of the animal, and on the result of this a decision was based.

Clinical and other Notes.

A SIMPLE METHOD USED FOR NOTING ANY UNDUE SICKNESS AMONGST THE TROOPS IN A DISTRICT.

By Major J. J. D. ROCHE.
Royal Army Medical Corps.

The general idea aimed at is to obtain early information which is so important from the point of view of a D.A.D.M.S.(San.).

Here in India the various sick ratios must be compared on A.F. A. 31 for the month with those of the corresponding month of 1913.

If monthly charts only are used, the results are gone into once per month, or twelve times per year, thus allowing few chances of investigation, and of, possibly decreased sick rates.

By the suggested method, the average constantly sick is checked daily, whilst the admission ratios similarly can be checked at suitable intervals. Card "A" shows the names of the stations, the average strengths during

Card "A." British.........October, 1923.........

Station	Average strength	Normal number in hospital	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
"M" ..	1,000 ..	24	+	+	+	+	+	+	+	+	+	+	+	+	+	–	–	–	–	–	–	–	–	–	+	+	+	–	–	–	–	–	–
			1	4	2	9	5	8	3	9	7	6	2	0	1	1	1	3	5	–	2	1	6	2	1	–	–	3	6	2	4	1	1
"H" ..	2,000 ..	48																															
"P" ..	1,500 ..	36																															

Note.—For Station "M," the number in hospital on the 1st was 25, on the 4th it was 33, on the 10th it was 30, on the 16th it was 21, on the 23rd it was 25, on the 25th it was 24, on the 29th it was 28, and on the 31st it was 23.

the preceding month, and the number of sick considered to be normal. The normal figure in this district is considered to be twenty-four per 1,000. The additional columns show the dates, and under each date is inserted a plus or minus, and the number greater or less than normal.

For purposes of comparison one card is kept for British and another for Indian troops. The information is obtained daily from A.F. A 27. The A.F. A 27 of any station which shows an excessive sick rate on two consecutive days is studied with a view to seeing which units are producing too many sick. Persistently high figures generally indicate the necessity for an investigation.

The strengths of the units are obtained from card "C."

Card "B" shows the number of admissions daily, and is added up at convenient dates during the month, such as 5th, 10th, 15th, 20th, and 25th. It is considered in association with card "A," on which the average strength of the troops is found.

CARD "B." DAILY ADMISSIONS TO HOSPITALS. INDIAN.........SEPTEMBER, 1923.........

Station	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
					7					19					34					49					64					78
"H" ..	2	1	0	4	0	2	1	6	3	0	1	2	0	5	7	3	5	1	6	0	8	2	4	1	0	0	7	2	5	0
					3					7					14					21					25					30
"K" ..	0	0	1	0	2	1	0	0	0	3	1	0	5	0	1	1	1	0	1	4	3	0	1	0	0	1	0	4	0	0

If the ratio of admissions per 1,000 is calculated to be greater than those of the corresponding month of any year chosen—in India this is 1913—the Officer Commanding can be informed, often with advantage, as he also desires to obtain the best possible results.

The ratio for 1913 is obtained from the monthly statistical chart, on which is shown the rates for the previous year and for 1913.

Card "C" shows by stations the average strength of each unit during the preceding month.

CARD "C." AVERAGE STRENGTH OF UNITS.........BRITISH.........1923.........

Station	Unit	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
"M"	I/X X X ..	550	564	578	532	549	583	571	495	502	563	524	591
"L."	K.R.L.I. ..	874	862	858	820	854	874	859	829	868	875	826	837

Card "D" relates to infectious diseases. On it are seen extracts from A.F. A 35 from each station, and in addition it shows in the last column the number of cases of each particular infectious disease to date.

This is convenient as it enables one to give full information both quickly and without trouble.

CARD "D" INFECTIOUS DISEASES......(NAME OF STATION)......BRITISH......1923......

Unit	Rank	Name	Date of onset	Whereabouts of case	Where contracted	Disease	Number to date
I/R.R. R.	Pte.	Jones, E. ..	9.1.23	Wellington Bks. No. 2	On leave at K.	Lobar pneumonia	1
2nd Btty. R.F.A.	Gnr.	Wills, J. ..	15.1.23	Baird Barracks, No. 16	Local infection	Amœbic dysentery. (Fresh)	1
2/R.F. ..	Cpl.	Thomas, W.H.	17.3.23	Fort William, No. 9	Local infection	Measles ..	1
2nd Btty. R.F.A.	Dvr.	Eccles, R. ..	21.3.23	Baird Barracks, No. 11	Camp N. ..	Lobar pneumonia	2
2/R.F. ..	L/Cpl.	Norton, L. ..	25.3.23	Fort William, No. 9	Contact of Thomas	Measles ..	2
1/R. H.I.	Capt.	Miller, P. A.	2.4.23	No. 3, B.I. Lines	Local infection	Amœbic dysentery. (Relapse)	2

Card "E" shows by months the number of any infectious disease by stations, families being shown in pencil, officers in red ink, and troops in black ink. It indicates clearly when a visit from the D.A.D.M.S.(San.)

would be advantageous. For example, three cases of enteric fever during the course of the year is of little importance, whereas three within the month probably necessitates inquiry on the spot.

CARD "E" ENTERIC GROUP............BRITISH.........1923.........

Stations	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
"G"	T	—	—	A G	B	—	—	—	—	A A A	A	—
"H"	G	—	—	—	—	—	G	—	—	—	—	—
"W"	—	T	T T	G	—	G	—	—	G	—	—	—
Total for month	2	1	2	3	1	1	1	0	1	3	1	0
Carried over ..	—	2	3	5	8	9	10	11	11	12	15	16
Total to date ..	2	3	5	8	9	10	11	11	12	15	16	16

Note.—T stands for typhoid.
A ,, para-typhoid A
B ,, ,, B
C ,, ,, C
G ,, enteric group

Warrant Officers, N.C.O.s and Men are shown in black ink.
Officers are shown in red ink.
Families are shown in pencil.

The enteric fevers are differentiated by using T, A, B, C, and G respectively, for typhoid, "Para A," "Para B," "Para C," and group.

Enteric group comprises those cases diagnosed from a rising Widal reaction, or on clinical grounds only. The other terms are used when the specific organisms have been recovered.

Similarly for dysentery, P, B, and G for protozoal, bacillary and dysenteric group.

When using these cards certain pitfalls must be avoided. For example, transfers are included under admissions on A.F. A 27, hence a hospital which receives cases from other hospitals for operations, etc., will show both high admissions and high constantly sick rates. Also it has to be remembered that the strength in a station is decreased or increased by the departures to camps, etc., or arrivals from the hills,

It is advantageous to have noted on A.F. A 27 the number of transfers in hospitals, and the number of persons detained during any part of the previous twenty-four hours.

My thanks are due to Colonel C. W. Profeit, A.D.M.S. U.P. District, for permission to publish this article.

His careful daily scrutiny of all sick returns inspired the writer to think how the necessary information could be obtained and quickly and easily recorded.

Constant inquiry as to, for example, how many cases of dysentery at "A," or how many for the month, and how many for the year, provided the necessary stimulus to the gradual evolvement of the system noted above.

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CASES FROM S.I. COAST DEFENCES.

By Major H. C. Hildreth, D.S.O.

Royal Army Medical Corps.

Case I.—Intussusception with Spontaneous Reduction.

I was called to see child M. H., aged $2\frac{1}{12}$ years, at 11 p.m. on January 1, 1924.

History.—The child had previously been quite well, but suffered from constipation. At 11 a.m. it was given a piece of cake to eat; vomiting set in about 12 noon. At 1 p.m. the child had a copious loose motion followed later by frequent passage of blood and mucus only. This condition continued nearly until 11 p.m., when the symptoms appeared to subside. The child was supported on its mother's lap in a sitting posture when I saw it, and I have ascertained since that from the onset of the symptoms she had frequently to take the child up on account of pain in the abdomen.

Condition.—Sunken-eyed, pallid and cold. Pulse, barely perceptible, 130. Temperature, sub-normal. Evidence of vomiting and of the passage of blood-stained motions was present. The child vomited mucus once during my visit.

On examination the abdomen was flaccid, no pain or tenderness was elicited on palpation, but a definite typical sausage-shaped tumour, roughly three to four inches in length, was felt and defined in the region of the descending colon; so defined was it, that it was noticeable by the parents at my examination; it felt doughy in consistence and larger at the upper than at the lower end; no variation in its consistence was detected; signe de Dance was evident; nothing was detected in the heart, lungs or other organs. The child was put to bed and treated for shock pending removal for operation. On seeing the child again in about half an hour's time, the general appearance had slightly improved, and the tumour appeared somewhat smaller, measuring about two to three inches in length.

By the time the child was admitted to hospital—a matter of one and a half hours—all symptoms had apparently disappeared, and the tumour could not be detected. The child was dieted for three days and discharged. Since then he has been perfectly well.

The house surgeon of the North Infirmary, Cork, informed me that two somewhat similar cases had recently been met with at the hospital.

Authorities, I think, doubt the possibility of spontaneous reduction, but I cannot imagine that the condition could have been anything else, as it bears no resemblance to the case reported by Dr. Sutherland, and quoted by Goodhart and Still, and to my mind more classical symptoms could rarely have been observed.

CASE II.—APPENDICITIS WITH UNUSUAL SYMPTOMS.

Gunner R. reported sick on the evening of January 3, 1924, complaining of pain in the abdomen.

Previous History.—Had been in hospital for a few days with a cold. He stated that for a few days prior to reporting sick he had pain in the abdomen which was of a colicky nature. Bowels had acted regularly, no vomiting.

Examination.—Pain referred to outer edge of rectus about two inches above A.S.S., abdomen flaccid; on pressure pain was only felt at the one spot; no rigidity and no tenderness except at the indicated spot; tongue exceptionally clean and moist; temperature 99° F., pulse 72, full and bounding.

Fomentations appeared to give instant relief, and the patient passed a comfortable night.

Morning, January 14, 1924.—Temperature sub-normal, pulse 64; patient stated he felt quite fit. He was detained in hospital for the day and given an enema with good result; diet, diluted milk.

At 5 p.m. the same day I was called to see him. Temperature was sub-normal, pulse 60. He again complained of an acute pain in the same spot, describing it as of a stabbing character. The outer edge of rectus was slightly rigid; the tongue was flabby and indented. The change in the appearance was very noticeable.

Appendicitis was diagnosed and the patient was transferred to the North Infirmary, Cork.

I am indebted to Dr. Galvin, House Surgeon, North Infirmary, Cork, for the notes subsequent to admission.

January 4, 1924.—Admitted at 7.30 p.m. complaining of pain in right iliac fossa. On examination, tenderness and slight rigidity along right outer border of abdomen. Temperature sub-normal; pulse 60; respiration 22. Ordered morphia $\frac{1}{6}$ grain and whey only by mouth.

January 5, 1924.—Patient spent a restless night, did not sleep and complained of acute pain. Operated on this morning; temperature 97·4° F.; pulse 70; respiration 24.

Operation.—Abdomen opened by gridiron incision. Appendix found to be inflamed and congested; large fæcal concretion in lumen. This was removed.

Evening.—Patient complained of a little pain in region of wound. Morphia $\frac{1}{6}$ grain given.

January 6, 1924.—Patient spent a comfortable night. Temperature sub-normal, pulse 64, respiration 28.

Convalescence was uneventful. Patient was re-transferred to Military Hospital, Spike Island, January 26, 1924.

January 28, 1924.—Patient discharged to attend awaiting furlough.

February 2, 1924.—*At* 3 *a.m.* he was brought to hospital on a stretcher

in a rigor and frothing at the mouth; temperature sub-normal; pulse 84; respiration 20. Examination of heart, lungs and abdomen was negative. The scar of operation was well healed and there was no tenderness. Warmth and a hot drink restored him to a normal condition in a couple of hours and he slept peacefully until 8 a.m. He was discharged in thirty-six hours but no clue as to the cause of the rigors could be discovered. He had no foreign service on his record.

The case is one which ended as mysteriously as it began. The absence of vomiting, slow pulse, subnormal temperature—except in the first evening—together with the slight rigidity and change in the character of the tongue, are unusual features in a case of appendicitis.

An explanation of the rigors would be interesting in the absence of any subsequent temperature.

Travel.

SINGAPORE.

By Mrs. E. HOPE FALKNER.

Sketches by Miss Hope Falkner.

Singapore is an extremely difficult place to describe in that it has many drawbacks; it is useless and misleading to omit these, and yet to convey appreciation in spite of them is no easy task. So much has been written about voyages that nothing further need be stated here except that all preparations for the time actually on board ship—twenty-seven to thirty days—should be as for India, only with a larger supply of thin clothing.

The whole of the journey from Port Said is usually very hot, and on a trooper there is seldom any kind of laundry.

Climate.

Anyone who has been here a long time complains of loss of energy, and a great grouse against the place is the lack of a hill station. To those who like a somewhat moist heat and can keep fit, Singapore is quite pleasant, but it is not a good place for convalescence. There is frequent rain and the country is always green, fine grass lawns are everywhere, and much tropical vegetation.

Fruit and flowers are far more plentiful than, say, in Bermuda, and the climate on the whole is far less trying than the average plain station in India. Mosquitoes abound and bite furiously, but they are not the dangerous kind. Malaria is not very prevalent, but there is a good deal of dengue fever about.

The temperature remains much the same all the year round with rather heavy rains towards the end and bad electric storms in the early spring.


Singapore Harbour, Singapore


Raffles Place, Singapore

Children do fairly well while quite young; the absence of fresh milk affects them somewhat, and they become pale but not actually ill. They should be sent home when 6 years old at latest.

Cost of Living.

This is one of the greatest drawbacks to this station. All foodstuffs are dearer than at home, and the canteen just saves the situation. Drinks come in duty free and so cost considerably less than in England. Fresh meat can be obtained locally, but whatever the market price the cook manages to steal a certain amount on everything.

Meat from the Cold Storage Company is fairly expensive and like all frozen articles is never so good as when fresh.

Chickens and ducks can be obtained locally for a few shillings each (plus cheating), and frozen ones much more expensively at the Cold Storage.

Servants.

These are nearly all Chinese and they have been allowed to come in and monopolize the labour market, form trade unions and secret societies, and practically dictate their own terms. Roughly they correspond to the Indian servant at double the cost. The ordinary requirements for senior people are:—

	Dollars		Dollars
One head boy	30	One coolie	20
„ second boy	25	„ syce	35
„ cook	30	„ gardener	20
„ amah	35	„ assistant gardener	15

Taking the dollar at 2s. 4d. it will be seen that this works out at rather over £25 per month, or more than £300 a year, a huge outlay for native servants.

The head boy is supposed to be responsible for and direct the other servants, dust the drawing-room and keep the silver clean. The second boy waits on "master" and both attend at table. The cook has the easiest job, doing nothing outside his kitchen; he goes off daily to buy vegetables, collect the ice, etc., and insists on being driven home in a rickshaw at about a shilling a time. This trifling item works out at about £20 a year, and quite half this sum must be allowed for mosquito burners to keep one's rooms habitable in the evenings.

The amahs—women servants—are a perfect curse here now. During the boom a few years ago they were paid enormous wages and have fought against reduction more than any other class of servant. Occasionally one gets a good one and they do the fine laundry work, iron one's frocks, and mend, etc.

A really good lady's amah is nearly impossible to obtain under £5 a month, and those who can't sew or wash sometimes come for less but are very little use. Children's amahs are much more easily obtained but cost

about the same. The Chinese woman is much more willing to take a job with children—involving as it does a good bedroom indoors and frequent motoring—rather than the less interesting job of looking after the "mem's" wardrobe. If any class of servant is dismissed more often than is approved a kind of "boycott" is arranged, specially amongst the amahs, and it is very trying in the heat to do without one, and to have to get up early and hang all one's clothes out on the verandah for a few hours' airing every day.

The coolie or tucanayer, as he is called locally, attends to the very primitive sanitary arrangements, washes floors, looks much the same as the other servants but has to do all the unpleasant jobs.

The syce may be either for horses or motor: personal experience

with a Malay has been most satisfactory, but house servants of this type are only obtainable up-country, and if imported are intimidated by the Chinese.

All the staff is at work by 6.30 a.m., stopping at 11 a.m. for food, and disappearing for sleep after tiffin. They do no real work except during the mornings—a very irritating custom—and as little as possible in the evenings.

The gardeners can sometimes be dispensed with; few Army people can afford an amah, and junior officers try to do with one boy instead of two. Otherwise the foregoing staff is the least possible number compatible with a comfortable home.

The servants are supposed to provide their own food, but pilfering

has been brought to such a fine art that they practically batten on the household.

Houses.

With the exception of the G.O.C.'s house—where General Malcolm has lovely gardens—the Army accommodation is very limited. There are two little groups of bungalows, one in Tanglin and one in Alexandra Barracks. The former is on a small hill, and sitting on the top is the Regimental Commanding Officer's quarters, an old-fashioned house with no conveniences, bad floors, and generally uncomfortable. There are other bungalows with inferior accommodation: this applies specially to Alex-


Cavanagh Bridge Singapore

andra Barracks, a small group miles away formerly used for a native regiment. As in many other stations, there have never been enough houses to go round. Some are being built here, however, and it is calculated that in about six months there will be a couple surplus.

Unfortunately the new ones are absurdly, grotesquely small, appearing more like dolls' houses, so that the main faults of the existing quarters are being perpetuated for all time.

On arrival last October, the outgoing regiment had provided some sort of accommodation for every member of the incoming one.

The two married R.A.M.C. officers and their families, viz., the S.M.O., wife and grown-up daughter, and a married captain, wife, child and nurse, were compelled to go to an expensive hotel.

It was then found that only one quarter was available anywhere for these two families, and intended for the S.M.O.

The quarter usually occupied by this officer is miles away from the hospital and further still from headquarters : and in fact the most outlying bungalow in the garrison.

It is better than many of the regimental ones, but at the time mentioned it had not been renovated for nine years, had no lights, no sanitation, and a poor water supply. The bathrooms consist of square holes cut in the corner of the flooring in each bedroom—all of which are upstairs—and a ladder-like staircase descends into small dark rooms with cement floors where baths can only be taken in great discomfort.

Owing to the lack of space, distance out, and want of conveniences the S.M.O. decided not to occupy this quarter; but when it was done up the married captain went into it under protest as the sole means of escaping his heavy hotel expenses. He still occupies this house, and had the S.M.O. not been willing to give it up this junior officer would still be in a hotel, where the lowest quotation possible for living expenses alone was within a few dollars of his entire pay and allowances.

After some three weeks in this hotel, at a cost of over £70, the S.M.O. found a large roomy house at a rental of £300 a year and which had previously been rented for double this sum. It had some furniture included; and there being no other quarter now available lodging allowance has been sanctioned.

It may be interesting to state that when ordering a telephone great indignation was expressed at the cost, which is £19 a year. The official was politely informed that only one instrument was required—not a dozen.

He somewhat snappily protested that people out here could afford these prices, being paid three times the usual home salary.

He was still more politely informed that this phone was required by an Army officer and not an oil magnate—whereupon he became most sympathetic and withdrew his previous remarks about the question of being able to afford it.

To return to the house question : owing to the size and spaciousness of this house, which contains a fine billiard room and has large grounds, it was possible to entertain all the married people and children and all the personnel of the Corps at a series of four parties given for the purpose during Christmas week.

It is hoped that it may be possible to hold further similar entertainments in the near future and at regular intervals.

Furniture.

Hardly anything is available on hire from barracks. All small things should be brought from home such as curtains and chintzes, glass and

china, enamelled bedroom ware, portable baths and kitchen utensils. Mosquito nets can be obtained at several shops at about 25s. per net. Every household article is approximately three times the price of home. Japanese straw carpets are largely used, wicker furniture is moderate in price locally, and more solid teak things can be made to order by excellent Chinese carpenters.

It is as well, however, to bring out anything already possessed as no one hurries in Singapore—any attempt at speed is definitely resented, and the irritation and the delays in procuring things are difficult to realize.

Electric light will soon be available in all military quarters—that is to say in a couple of years with luck—and our old friend the kerosene tin may yet disappear. Needless to say that electric light and all modern conveniences are already in all but the very oldest civilian residences.

Motor Cars.

There are more cars in proportion to the population here than anywhere else. As there are no paths except in the town, people cannot very well walk, the roads being thronged with bullocks, natives, trams, rickshaws and cars.

Motors are amongst the very few things cheaper than in England —there being no duty—and American cars average out about £100 less each than in England for any of the makes up to £500.

For instance, a 1924 Studebaker five-seater with bicycle wheels costs £300. One exception is Henry Ford, whose cars are sold locally at £30 each dearer than in London for the totally inadequate reason that "there is such a demand." The local agent sells six Ford cars every day.

In this connexion it may be pointed out that few junior married officers can afford any car, and in consequence some of the wives can hardly get about at all, leading terribly dull lives and dependent on "lifts" from long-suffering friends.

In contrast to this all business people, office clerks, petty bank officials, etc., seem to have some conveyance; and indeed their comparative prosperity in all directions is striking and seen perhaps more than anywhere in their housing accommodation.

Sports.

There is no military club of any description, but the handful of officers and families are allowed to join existing clubs on favourable terms. There is a good racecourse where there are three-day meetings every half year. The horses are mostly Australian and the jockeys are imported for the occasion, and both tour round to many other meetings within reach. These animals are chiefly owned by local Sultans, of whom Johore and Perim have perhaps the biggest stables.

Hacking is practically out of the question partly owing to the cost of upkeep and the very limited riding ground available.

The polo club is not a very impressive affair and the polo available can hardly be considered first class.

The yacht club is a funny little bungalow near the sea only possible to get to by driving through slum areas of the city.

Sailing is expensive and unsatisfactory owing to defects in the design of the one class of boat available, and because of the difficulties is only indulged in by the very keenest devotees.

Tennis is available most of the year and the grass courts are excellent. Cricket, golf and football are all played, also hockey.

All sports gear perishes quickly and is best brought out fresh from home. There is any amount of dancing, specially for those who do not mind with whom they dance. The floors are excellent but some of the bands are decidedly the reverse.

CLOTHING.

As in the case of household goods, almost anything from home is about three times the price. Really good models are extortionate and seldom obtainable. Indian and Chinese durzies do exist but cost about twice as much as in India. They have no fixed charges and any job means a running fight, the result depending on who gets tired first. *They* seldom do. Men's suits are quite well made by Chinese who make good white ones for about 18s.

There is a horrible local custom of wearing white dinner suits for the absurd reason that "they feel comfortable." They look like nothing on earth and will never be admired by the ladies. Khaki can be made more cheaply than at home, but it is a good plan to have a pattern suit. Women are not nearly so well catered for, and those who have any pretensions to being well dressed should bring out everything.

Stockings, and silk by the yard, even local products, are really no cheaper than at home, except for an occasional bargain.

Gloves get mouldy and are little worn except in the evening for big shows. Shoes have to be brushed over daily but old ones can be re-covered with brocade locally for about £1 including material. Other shoes made here are never quite satisfactory and are just as expensive as at home. Glace, taffetas, and fine silk simply fall to pieces, but cottons, crepons, washing silks, and crèpe-de-chine last all right.

Chinese washermen are not as good as might be expected. They do not tear things as the Indian dhobi does but are expert in removing colour, and not very good at finishing. They charge about 30s. a month for a small household. Plain morning frocks easily washed and not transparent, and everything loose and straight, are much needed: garments hanging straight are cooler than those belted at the waist. A few good afternoon frocks for Government House and other at homes are required, also plenty of the less expensive type of evening frock.

Sun helmets are not worn much by women, who use thick hats and sun umbrellas in the day time, but these are not sufficient for Port Said or other ports of call on the voyage out.

Light wraps are useful for motoring when the heated body feels quite chilled, and after tennis and for night use.

Cotton mosquito boots of Russian shape are useful.

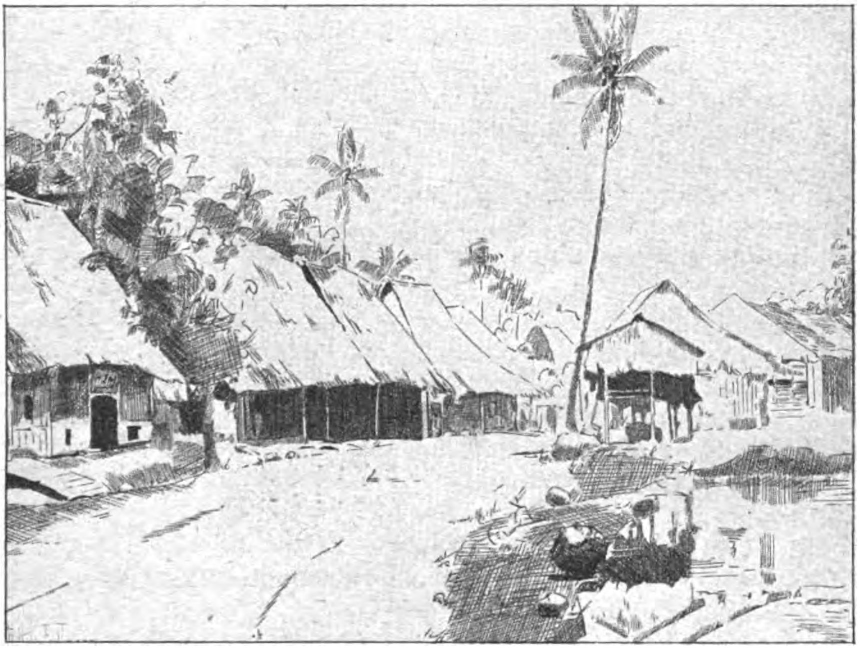
GARRISON, &c.

The garrison consists of one battalion of British infantry and two companies of Royal Garrison Artillery, one company of R.A.M.C. and the usual details. There is also a battalion of Indian infantry stationed at Taiping.

So far the Navy has very little personnel, there being only three or four officers stationed here in connexion with the Naval Base work.

There are three hospitals in all for the troops in this Command. One of these is in Tanglin Barracks, the other on the Island of Blakang Mati, and the third at Taiping.

The pay in this station is as follows. The pay and allowances of a Lieutenant-Colonel officiating as Senior Medical Officer are: Pay £70 per



On the main road to Johore.

month; allowances about £50 per month, including lodging allowance. When lodging allowance cannot be drawn this sum is cut down by about £13 and a quarter provided.

Majors receive exactly the same as at home except for the Colonial allowance of 4s. per day.

Captains the same as at home with 3s. per day Colonial allowance.

Most civilians obtain in cash or kind a sum equivalent to their home salary multiplied by three, and even then are not satisfied.

A very senior Army man receives rather less than a third more, while the increase for a junior is negligible.

Civilians are nearly all exempt from home income-tax, though some of them pay a trifling percentage out here.

Army people get the same pay as at home with little increase to meet the high local charges; they have to pay full income-tax, and are literally paid in shillings in a country where it actually takes two and a half shillings to buy one shilling's worth.

In conclusion it may be said that the surrounding district is very beautiful. There are delightful motor drives on excellent smooth roads, parts of the country looking like the road from Monte Carlo to Menton; there are lovely groves of palms, patches of the less interesting rubber trees and stretches of real jungle, all within twenty minutes of the barracks.

On the main road to Johore.

In the opposite direction lie the Straits full of shipping of all nations.

A busy spot is Singapore, a coming place it might be thought but for the rapacity of the business man and the inertia of the native.

Let salaries be more generous, tradespeople less greedy, and find some method of speeding up things and Singapore may yet become the hub of the universe.

Current Literature.

X-ray and Radium Protection Committee.—*Chairman:* Sir Humphry Rolleston, K.C.B. (President of the Royal College of Physicians). *Members:* Sir Archibald Reid, K.B.E., C.M.G. (St. Thomas's Hospital); Dr. Robert Knox (King's College Hospital); Dr. G. Harrison Orton (St. Mary's Hospital); Dr. S. Gilbert Scott (London Hospital); Dr. J. C. Mottram (Pathologist to the Radium Institute); Dr. G. W. C. Kaye, O.B.E. (National Physical Laboratory); Mr. Cuthbert Andrews. The following Revised Reports Nos. 1 and 2, of the X-ray and Radium Protection Committee, December, 1923, are published for general information. The abstract of the 1921 reports published in the Regulations for the Medical Services of the Army, 1923, Appendix No. 16, referred to in paragraph 46 of the same book are still adequate for service installations generally, but the added detail of the revised reports will be of great physical and technical interest to all radiographers and radiologists in the Medical Service of the Army, who might otherwise be unable to get them.

Revised Report No. 1.

Introduction.—The danger of over-exposure to X-rays and radium can be avoided by the provision of efficient protection and suitable working conditions.

The known effects on the operator to be guarded against are: (1) Visible injuries to the superficial tissues, which may result in permanent damage; (2) derangements of internal organs and changes in the blood. These are especially important, as their earlier manifestation is often unrecognized.

General Recommendations.—It is the duty of those in charge of X-ray and radium departments to ensure efficient protection and suitable working conditions for the personnel.

The following precautions are recommended: (1) Not more than seven working hours a day; (2) Sundays and two half-days off duty each week, to be spent as much as possible out of doors; (3) an annual holiday of one month or two separate fortnights.

Sisters and nurses, employed as whole-time workers in X-ray and radium departments, should not be called upon for any other hospital service.

Protective Measures.—It cannot be insisted upon too strongly that a primary precaution in all X-ray work, whether with stationary or portable sets, is to surround the X-ray bulb itself as completely as possible with adequate protective material, except for an aperture as small as possible for the work in hand.

The protective measures recommended are dealt with under the following sections:—

I. X-rays for diagnostic purposes.
II. X-rays for superficial (low-voltage) therapy.
III. X-rays for deep (high-voltage) therapy.
IV. Electrical precautions in X-ray departments.
V. Ventilation of X-ray departments.
VI. X-rays for industrial and research purposes.
VII. Radium therapy.

It must be clearly understood that the protective measures recommended for these various purposes are not necessarily interchangeable; for instance, to use for deep therapy the measures intended for superficial therapy would probably subject the worker to serious injury.

It should further be pointed out that the protective values of certain materials are much affected by a change in the voltage applied to the X-ray tube. This applies particularly to materials in which lighter elements than lead furnish the chief protection. The importance of obtaining a National Physical Laboratory test in this connexion is emphasized. In the case of protective slabs or plasters made up of a mixture of materials, the difficulty of securing uniform mixing should be met by a generous margin of safety in estimating the required thickness.

I.—X-rays for Diagnostic Purposes.

(1) *Screen Examinations.*

(*a*) The X-ray bulb should be enclosed as completely as possible with protective material equivalent to not less than two millimetres of lead. The material of the diaphragm should be equivalent to not less than three millimetres of lead. The design of the diaphragm should be such as to permit it to be completely closed. The simpler rectangular forms of diaphragm will, in general, be found preferable to the iris type.

In the case of installations which are incapable of generating peak voltages exceeding 70,000, the lead value of the tube enclosure may be reduced to 1·5 millimetre and of the diaphragm to two millimetres.

(*b*) The fluorescent screen, attached as a permanent fitting to screening stands, etc., should be fitted with lead glass equivalent to not less than two millimetres of lead. In all positions the lead glass should be large enough to cover the area irradiated when the diaphragm is opened to its widest. For screens of smaller area, the lead glass should be mounted in a frame of protective material which overlaps the screen and is of adequate width and thickness to afford protection in all positions of the screen. In the case of portable screens considerations of weight militate against the recommendation of a degree of protection greater than one millimetre of lead. As far as possible the glass should be of uniform thickness and free from striations and air bubbles.

(*c*) To afford protection from scattered radiation in the case of a couch, a protective screen, mounted on the carriage and of material equivalent to not less than two millimetres of lead, should be employed between the

operator and the X-ray box. In addition, a device such as a "collar" of protective material between the tube box and the underside of the couch is effective. In the case of a screening stand, an "apron" of protective material should be attached to the lower edge of the screen, and panels of protective material mounted on each side of the patient.

(*d*) Protective gloves should be of lead rubber (or the like) and afford protection for both back and front of hand (including fingers and wrist). The protective value should be not less than half a millimetre of lead. Gloves should preferably be lined with leather or other suitable material. (As practical difficulties militate at present against the recommendation of a greater degree of protection, all manipulations during screen examination should be reduced to a minimum.)

(*e*) In those cases where the necessity is felt for even greater protection for the operator, goggles and aprons may advantageously be worn. The glass of the goggles should have a lead value not less than half a millimetre; aprons should have lead values not less than one millimetre.

(*f*) A minimum output of radiation should be used with the bulb as far from the screen as is consistent with the efficiency of the work in hand. Screen work should be as expeditious as possible.

(2) *Radiographic Examinations* ("*overhead*" *equipment*).

(*a*) The X-ray bulb should be enclosed as completely as possible with protective material equivalent to not less than two millimetres of lead. This figure may be reduced to 1·5 millimetre in the case of installations which are incapable of generating peak voltages exceeding 70,000.

(*b*) The operator should stand behind a protective screen of material equivalent to not less than two millimetres of lead. In general, such screens should not be less than 3 feet 6 inches wide and 7 feet high, and should extend to within 1 inch of the ground. If a window is provided, its lead equivalent should not be less than two millimetres. Its dimensions need only rarely exceed nine inches by six inches.

II.—X-rays for Superficial (Low-voltage) Therapy.

It is difficult to define the line of demarcation between superficial and deep therapy.

For this reason it is recommended that, in the re-organization of existing or the equipment of new X-ray departments, small cubicles should not be adopted, but that the precautionary measures suggested for deep therapy should be followed.

The definition of superficial therapy is considered to cover sets of apparatus giving a maximum peak voltage of 100,000 (fifteen centimetres spark gap between points; five centimetres spark gap between spheres of diameter (five centimetres).

Cubicle System.—Where the cubicle system is already in existence it is recommended that:—

(1) The cubicle should be well lighted and ventilated, preferably provided with an exhaust electric fan in an outside wall or ventilation shaft and suitable air inlets. The controls of the X-ray apparatus should be outside the cubicle.

(2) The walls of the cubicles should preferably not take the form of partitions, but should extend from floor to ceiling. If partitions are adopted, they should be not less than nine feet in height and extend to floor level.

(3) The walls (and where necessary the floor and ceiling) of the cubicle should be of material equivalent to not less than two millimetres of lead. Windows should be of high quality lead glass of equivalent thickness. They need only rarely exceed nine inches by six inches in dimensions. Care should be taken that the protective material overlaps at joints.

(4) The X-ray bulb should be enclosed as completely as possible with protective material equivalent to not less than two millimetres of lead. This figure may be reduced to 1·5 millimetre in the case of installations which are incapable of generating more than 70,000 volts.

III.—X-rays for Deep (High-voltage) Therapy.

This section refers to sets of apparatus giving peak voltages above 100,000.

(1) Small cubicles are not recommended.

(2) A large, lofty, well-ventilated and lighted room should be provided, preferably with an exhaust electric fan in a suitable air duct.

(3) The walls (and where necessary the floor and ceiling) of the room should provide protection equivalent to not less than three millimetres of lead. Windows should be of high quality lead glass of equivalent thickness. They need only rarely exceed nine by six inches in dimensions. Care should be taken that the protective material overlaps at joints.

(4) The X-ray bulb should be enclosed as completely as possible with protective material equivalent to not less than three millimetres of lead.

(5) A separate enclosure should be provided for the operator, situated as far as possible from the X-ray bulb. All controls should be within this enclosure, the walls and windows of which should be of material equivalent to not less than three millimetres of lead.

IV.—Electrical Precautions in X-ray Departments.

(1) Wooden, cork, lino, or rubber floors should be provided; existing concrete, or similar, floors should be covered with one of the above materials.

(2) Stout metal tubes or rods terminating in spheres should, as far as possible, be used instead of wires for conductors. Overhead conductors should not be less than nine feet from the floor level. The connecting leads from the overhead conductors to the X-ray tube should be brought down in positions as remote as possible from the operator and the patient.

The provision of thick-walled insulating tubing to shield the more adjacent parts of the connecting leads is recommended. Thickly insulated wire is preferable to bare wire. Slack, looped or low-hanging wires should be avoided. Small spring tapes should be replaced by rheophores of robust design with heavily insulated wire.

(3) All metal parts of the apparatus and room should be efficiently earthed.

(4) All main and supply switches should be very accessible and distinctly indicated. It should not be possible to close them accidentally. Wherever possible double-pole switches should be used in preference to single-pole. Fuses no heavier than necessary for the purpose in hand should be used, together with quick-acting double-pole circuit breakers. The possibility of unemployed leads to the high-tension generator should be prevented by interlocking switches or the like.

(5) Alternative spark gaps (preferably of the sphere type) should be provided. They should be furnished with centimetre or inch scales, together with a voltage scale. The spark gaps should be situated in positions where they can easily be read and adjusted while the tube is in operation.

V.—Ventilation of X-ray Departments.

It is strongly recommended that the X-ray department should not be below the ground level. In general, ceilings should not be less than eleven feet in height. The presence of steam-piping and the like must be allowed for. Damp rooms should be avoided.

(2) The importance of adequate ventilation in both operating and dark rooms is supreme. Artificial ventilation is recommended in most cases. With very high potentials coronal discharges are difficult to avoid, and these produce ozone and nitrous fumes, which are prejudicial to the operator. Rotating rectifiers often require the provision of a special ventilating duct or like measure. Unenclosed rectifying spark gaps are better replaced by enclosed types. If vacuum valves are used, the fact that they may produce X-rays should not be lost sight of.

All rooms, including dark rooms, should be capable of being readily opened up to sunshine and fresh air when not in use. The walls and ceilings of all rooms, including dark rooms, are best painted some light hue.

VI.—X-rays for Industrial and Research Purposes.

The preceding recommendations will probably apply to the majority of conditions under which X-rays are used for industrial and research purposes.

VII.—Radium Therapy.

The following protective measures are recommended for the handling of quantities of radium up to one gramme:—

(1) In order to avoid injury to the fingers the radium, whether in the form of applicators of radium salt, or in the form of emanation tubes,

should always be manipulated with forceps (preferably wooden) or similar instruments, and it should be carried from place to place in long-handled boxes lined on all sides with one centrimetre of lead.

(2) In order to avoid the penetrating rays of radium all manipulations should be carried out as rapidly as possible, and the operator should not remain in the vicinity of radium for longer than is necessary.

The radium when not in use should be stored in an enclosure, the wall thickness of which should be equivalent to not less than eight centimetres of lead.

(3) The handling of emanation should, as far as possible, be carried out during its relatively inactive state. In manipulations where emanation is likely to come into direct contact with the fingers thin rubber gloves should be worn. The escape of emanation should be very carefully guarded against, and the room in which it is prepared should be provided with an exhaust electric fan.

General.—The governing bodies of many institutions where radiological work is carried on may wish to have further guarantees of the general safety of the conditions under which their personnel work.

(1) Although the Committee believe that an adequate degree of safety would result if the recommendations now put forward were acted upon, they would point out that this is entirely dependent upon the loyal co-operation of the personnel in following the precautionary measures outlined for their benefit.

(2) The Committee would also point out that the National Physical Laboratory, Teddington, is prepared to carry out exact measurements upon X-ray protective materials and to arrange for periodic inspection of existing installations on the lines of the present recommendations (see Report No. 2).

(3) Further, in view of the varying susceptibilities of workers to radiation, the Committee recommend that wherever possible periodic tests, e.g., every three months, be made upon the blood of the personnel, so that any changes which occur may be recognized at an early stage. In the present state of our knowledge it is difficult to decide when small variations from the normal blood-count become significant.

Report No. 2.

In view of the widespread uncertainty and anxiety as to the efficacy of the various devices and materials employed for the purposes of protection against X-rays, the X-ray and Radium Protection Committee strongly advise that the heads of X-ray Departments of hospital and other institutions should safeguard themselves and their staff on this score by recommending to the hospital authorities the adoption of the following precautions:—

(1) The various protective appliances should be inspected and reported on by the National Physical Laboratory (N.P.L.), Teddington. In the

event of an adverse report, early steps should be taken to carry out the recommendations of the Laboratory. The Laboratory is prepared, wherever possible or expedient, to engrave (or otherwise suitably mark) the N.P.L. monogram and year of test on such appliances as provide the full measure of protection laid down in the Revised Report No. 1 of the Protection Committee. It should be pointed out that, in the case of materials which may deteriorate, e.g., lead rubber, such inspection should be periodic, say every twelve months.

(2) Within the Committee's recent experience, the working conditions of X-ray departments, e.g., lay-out of installations, degree of scattered radiation, ventilation, high tension insulation, etc., are often unsatisfactory. It is recommended that such conditions be inspected by the N.P.L., and that early steps be taken to give effect to such alterations as may arise out of their report. It is advised that, in the planning of new radiological departments, advantage be taken of the facilities available at the N.P.L.

(3) Manufacturers of X-ray apparatus are also invited to assist in reassuring the public by actively co-operating with the Committee in its recommendations. It is suggested that protective materials or equipment should not be sold or incorporated into an installation unless accompanied by a specification based upon an N.P.L. certificate or report stating, in terms of the equivalent thickness of lead, the degree of protection afforded.

In the interests of both the trade and profession, it is urged that manufacturers should put themselves into a position to be able to guarantee that their apparatus complies completely with the recommendations of the Committee.

(4) The Committee recommend that the various instruments dealing with the measurements of current (ammeters and milliammeters) and voltage, be standardized by the N.P.L. With reference to the measurement of secondary voltage, the Committee recommend that every installation should be provided with adequate means for enabling this to be easily effected, e.g., by kilovoltmeter, sphere-gap voltmeter, or the like.

(5) The Committee would further urge that heads of X-ray Departments should insist upon complete N.P.L. inspection of imported materials and apparatus.

Reviews.

THE PRIMARY PROBLEMS OF MEDICAL PSYCHOLOGY. London: J. Bale, Sons and Danielsson, Ltd. 1923. Pp. vii + 142. Price 7s. 6d.

Dr. Ch. de Montet has attempted a very difficult task in a small compass. In many psychological works it is difficult to grasp the primary conception of the writer, but the author here starts by stating his own supposition to which he returns in his arguments throughout the book. The author is a "consciousness" psychologist; he gives in his introduction a definition of what he implies by the word consciousness, and in the following chapters attempts to prove that his definition conforms to facts. The book is interesting reading, especially in the first part which deals with independent experiences, although we cannot agree with some of the author's statements. He finds himself unable to agree with the commonly accepted definitions of hallucinations and illusions, because he maintains that consciousness (i.e., life) always remains in touch with reality. In the remarks on treatment towards the end of the book, his method, based on the theory of probabilities, consists in the consideration of average values, and he recognizes that one must not be misled by the isolated and individual case. There seems to be little new in this method which is practised by all to a greater or less extent. The author does not belong to the psycho-analytic school, he is inclined to be apologetic when putting forward his various arguments, and while there is much of interest in the book the psychological knowledge is not easily digested. W. L. W.

COMMON SYMPTOMS OF AN UNSOUND MIND. London: H. K. Lewis and Co., Ltd. 1923. Pp. xviii + 268. Price 7s. 6d.

Dr. Jeffrey has written a book which he calls "A Guide for General Practitioners." This aptly describes it. In no sense should this be considered a textbook or manual. It is written from a novel point of view, and describes the symptoms of mental disease as they occur in the practice of the general practitioner, who is often placed in a position of great difficulty when confronted with symptoms which may be those of mental disease, and upon whose opinion so much depends.

This book is sympathetically written, it fully acknowledges the general practitioner's difficulties, and the fact that he has to make up his mind rapidly without any prolonged period of observation of his cases, which is so often necessary before a final diagnosis can be made. It presents a series of pictures representing the main symptoms of mental disease to which the practitioner can refer in order to recognize their significance, understand their danger and judge the future progress of his patients.

The pictures are given under the heading of Delusion associated with

Mental Enfeeblement, or Apparent Mental Integrity, of Illusions and Hallucinations, of States of Exaltation, Excitement, Depression and Confusion and of Perversions of Conduct, while the last chapter contains some observations regarding the Legal and Medical significance of Mental Unsoundness.

The chapters are amplified by the history of actual cases.

At the present time, when the early treatment of mental symptoms is so much to the fore in public life, a book of this kind is of value to all who have to deal with patients who exhibit them. It is at this period that much can be done to help the patients to recover, but at the same time the doctor must realize his responsibility and the risks he has to face.

The mentally ill patient is unfortunately still popularly considered to be a "madman," the relations resent the fact that the case is mental and wish to "keep things quiet"; this attitude often ends in a catastrophe. A book such as this will help in avoiding such incidents and it certainly fills a want because the average medical student has little opportunity of seeing cases of incipient mental diseases prior to their certification.

The work is written throughout in a pleasing manner. The author's sympathy with his patients and all who have to deal with them is refreshing, and although many points suggest themselves for criticism the book can be confidently recommended. W. L. W.

Canned Foods in Relation to Health. By W. G. Savage. Cambridge University Press. 1923. Pp. 144. Price 8s. 6d. net.

The ever-increasing strides made in the canned food trade during recent years demonstrate its importance as a source of the food supply of large communities, and further developments in the output and number of foods canned may be confidently expected in the future. It is only within recent years that the industry has been removed from an empirical to a scientific basis.

Dr. Savage has made a most important contribution to the literature of the Public Health view of this growing and valuable method of food preservation. In his book, which consists of the Milroy Lectures for 1923, as delivered before the Royal College of Physicians, London, the author has made a concise and exhaustive review of the whole subject mainly from his conclusions after four years' detailed laboratory study of canned food and inquiries made by him into the methods of manufacture both in this country and in North America.

The causation and prevention of spoilage and the bacteriology of canned foods from this point of view are discussed at length. While spoilage is a problem which primarily concerns the canner, it is indirectly a health consideration in that the proportion of spoilage directly affects the price of this type of food.

The popular conception that canned food remains sound because it is sterile is criticized. In an analysis of various types of canned food by the

author no class of product was found always to be sterile, and the organisms found to be present were shown to be similar to those which are known to produce spoilage under other conditions.

The number of outbreaks of food poisoning directly attributable to the consumption of canned foods is not considered in the author's opinion to be out of proportion to those where fresh foods have been the vehicles of infection. The risk of Salmonella poisoning from this source is not regarded lightly, as probably many of the milder cases are not recorded. In this connexion it is pointed out that the food though toxic is indistinguishable from sound food and that tins of such infected food are undetectable by any precautions which can be adopted by Food Inspection Authorities. Infection is, however, rarely found in more than a tin or two out of any consignment examined, and has invariably been introduced at the place of canning. The risk of botulism from canned food is a real one but insignificant in its incidence, and it is noteworthy that food containing botulism toxin is usually obtrusively unsound. Owing to the considerable heat-resisting powers of *Bacillus botulinus* spores, "processing" cannot be relied on as a safeguard.

An account is given of the stability of the vitamins at present known in relation to the methods of preparing food by canning.

The necessity for adequate methods for the supervision of the manufacture of canned foods is obvious, and the author's description of the efficiency of the United States Federal Meat Inspection Service and of the National Canners Association is reassuring as to what can be done in this respect.

The author has demonstrated that the present unsatisfactory inspection methods which obtain in this country result in the condemnation and wastage of a considerable amount of sound food and recommends the extension of laboratory facilities for carrying out these examinations.

Dr. Savage advocates that it should be made compulsory to stamp every tin with a code mark and the date of manufacture in order to facilitate identification during food poisoning outbreaks. The second requirement has been adopted by the Army for a number of years and has produced no evidence that the practice is in any way prejudicial to the manufacture.

There are two most valuable appendices to the book. One is a very complete scientific description of the principles involved in the "processing" of canned foods, and the other is a description of the laboratory methods and routine adopted by Dr. Savage with such conspicuous success.

Correspondence.

MITES ON MOSQUITOES.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—With reference to the interesting article on "Parasitic Mites on Mosquitoes," by Captain W. H. Dye, R.A.M.C., in the February number of the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, it is curious that the males do not suffer from the presence of these parasites, as it was found that in the specimens of *A. maculipennis* examined at the War Office Entomological Laboratory, at Sandwich, Kent, males were also infested.

Larval mites were found on 4 out of 277 males, about 1 in 69; and on 70 out of 3,970 females, about 1 in 56 (*vide* JOURNAL OF THE ROYAL ARMY MEDICAL CORPS for June, 1922).

The females were, however, more heavily infested than the males; one female carried thirty-three, but only three or four were found on each of the males.

The drawings of the parasites reflect great credit on the artistic attainments of Captain Dye, and it is hoped that after reading the entomological articles in the February Journal more officers of the Corps will submit papers on this interesting and important branch of medical science.

B.S.H., I am, etc.,
Multan Cantt., J. ENOLEN BOYD,
March 4, 1924. *Major, R.A.M.C.*

COMMANDING OFFICERS OF THE CONNAUGHT HOSPITAL.

TO THE EDITOR OF "THE JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—I would be greatly obliged if any of your readers could help me to obtain an accurate list of the officers who have commanded the Connaught Hospital since its foundation.

The following list may or may not be complete :—

Lieutenant-Colonel — Wilson ...	1899-1901.
Lieutenant-Colonel T. A. B. Tuckey ...	1901-1903.
Lieutenant-Colonel J. I. Routh ...	1903-1905.
Lieutenant-Colonel J. H. R. Moberley	1905-1908.
Lieutenant-Colonel H. M. Sloggett ...	1908-1911.
Lieutenant-Colonel W. Turner ...	1911-1914.
Lieutenant-Colonel H. C. Thurston ...	1914.
Colonel W. Turner	1914-1919.
Lieutenant-Colonel J. W. H. Houghton	1914-1922.

I am uncertain as to the date on which the hospital was first opened and who was its first commanding officer.

Connaught House, I am, yours, etc.,
Marlborough Lines, S. BOYLAN SMITH,
Aldershot. *Lieutenant-Colonel, R.A.M.C.*
March 10, 1924.

Notices.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts, and commands at home and abroad.

All such Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notified at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

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Any demand for *reprints, additional to the above*, or for excerpts must be forwarded at the time of submission of the article for publication.

Matter intended for the Corps News should reach the Editor not later than the 15th of each month for the following month's issue. Notices of Births, Marriages, and Deaths are inserted free of charge to subscribers. All these communications should be written upon one side of the paper only; they should by preference be type-written; but, if not, all proper names should be written in capital letters (or printed) to avoid mistakes, and be addressed: The Editor, "Journal of the Royal Army Medical Corps," War Office, Whitehall, S.W.1.

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ASSISTED BY

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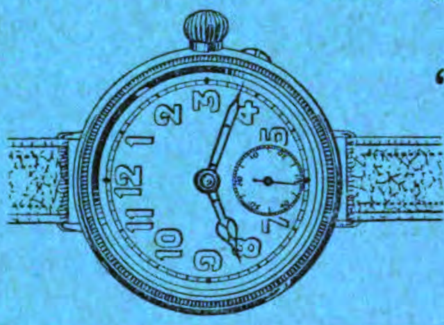

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Journal of the Royal Army Medical Corps.

Original Communications.

YELLOW FEVER IN GIBRALTAR IN 1804.

BY SIR JAMES KINGSTON FOWLER, K.C.V.O., C.M.G.
Lieutenant-Colonel, Royal Army Medical Corps (T.), Ret.
Consulting Physician, British Expeditionary Force, Rouen Base, 1916; Member of the Colonial Advisory Medical and Sanitary Committee.

AMONG the archives of the Army Medical Services a formidable looking volume, measuring nineteen inches by twelve inches and consisting of 262 closely written manuscript pages in faded ink, has recently come to light entitled:—

Reports relative to the Diseases of
Gibraltar
by
W. W. Fraser,
Deputy Inspector of Hospitals,
etc. etc. etc.
Felix qui potuit rerum cognoscere causas.

The Director-General (Sir William Leishman), one of my colleagues on the Yellow Fever Commission (West Africa), 1913, of which I was Chairman, suggested that possibly I might be able to find in it material of sufficient interest for an article in this Journal. Whether I have done so must be decided by the reader. It seemed at first sight a rather stiff job, as it opens with a quotation covering a whole page from "Observations on Epidemics by Dr. James Sims," and continues in a rather discursive style to review the medical history of the Rock, beginning as far back as the views of the Spanish authors on the epidemic histories of the time of David, king of Israel, or about 1,800 years before Christ!

After eleven pages of retrospect, in which plague, pestilences, malignant tertian, scurvy, influenza, and other disorders are mentioned, the writer indulges in long extracts from the "Epidemiologica Española," and finally, p. 15, arrives at the year 1800, when, after expressing regret for the absence of more distinct and positive matter, he refers to the "official documents collected by Colonel Wright and his own [i.e., Colonel Wright's] invaluable manuscript [which] I shall largely transcribe as the only means of completing my report."

Here things seemed to take a turn for the better, and I became more hopeful; as to how much of what follows is "Fraser" and how much is "Wright" is doubtful—I incline to the "Wright" view. I agree with Colonel Harvey that the epidemic with which this Report deals was one of yellow fever, and I hope to show that a critical analysis of its features is worth the trouble and is not a mere dry-as-dust story, without value at the present time.

One of the duties of the Yellow Fever Commission was to consider the reports of cases suspected to be yellow fever which had occurred in the West African Colonies during recent years, and to classify them upon the basis of (*a*) yellow fever, (*b*) probably yellow fever, (*c*) possibly yellow fever, and (*d*) negative.

I do not suggest that we were always unanimous, but when the disease was fatal and the words "black vomit" occurred the opposition obviously weakened; their "last ditch" was the absence of a post-mortem examination. I cannot recall that Sir William Leishman and I ever differed in our view as to the category in which a case should be placed.

Symptomatology.

The reading of many narratives such as this, when there is a doubt as to the nature of the disease, has impressed me with the conviction that they lose much from the absence of an attempt at the outset to put before the reader a clinical picture of the features of the epidemic, as precise as is possible. Of course in one dealing with 1804 we do not look for temperature charts, urine analysis, or "Faget's sign"; but as to the latter we may find it, in part at least, if the cases are carefully reported.

The first statement of interest is as follows (p. 41):—

"On October 18th 1804 Mr. Pym, Surgeon major who for some years had been head of the Medical Department arrived from Malta" where he had been absent on sick leave and from whence he hurried to Gibraltar on hearing of the epidemic. "Previous to giving his opinion Pym wished to receive from the Faculty a particular description of the nature and symptoms of the disease and for this purpose he drew up a number of Queries on the subject."

A very wise beginning. The replies from the town physicians appear to have fallen into the sea and "were so much destroyed by sea water as to be illegible," but that from Dr. du Cabanellos, to whom a special question-

naire was sent, gave exactly what was wanted. Dr. du Cabanellos was "a physician of celebrity" in Spain "who had had the advantage of having seen more of the disease in Europe than perhaps any other man existing. Having been at Seville in 1800 when upwards of 70,000 were attacked with it and he also happened to be at Carthagena in charge of the Public Lazaretto on the present occasion." His answers, in which he gave the general results of his experience, but not apparently founded on observation of the epidemic then prevailing in Gibraltar, as translated by Mr. Price, the English Consul, were as follows :—

"No. 1.—The Bowels during life seldom present anything exteriorly, the Cavity of the Stomach being generally natural, flexible and soft, excepting the region of the Liver where there is often experienced a certain degree of tension painful to the touch" (p. 43) (epigastric tenderness).

"No. 2.—On dissection parts of the Stomach, Bowels and Liver have frequently been found mortally gangrened."

"No 3.—The Excrements are bilious and of various Colours and towards the close of the Disease are in most cases black as Pitch and Bloody" (melæna).

"No. 4.—The urine in the beginning is generally of the natural colour, afterwards it is muddy with a dark sediment" (not blackwater).

"No 5.—The majority have their eyes yellow during the disease and in many the skin turns yellow."

"No. 6.—All the Bodies after Death have generally exhibited black spots at one or two palms distance and most commonly on the Hips."

"No. 7.—The Tongue in the beginning is moist and white, which as the Disease advances changes in many to black with longitudinal fissures in the middle."

"No. 8.—Vomiting is frequent and is one of the most fatal symptoms of the Disease, towards the end of it. In the beginning of the fever the vomiting is always bilious, but at the last part of the Disease it is always loose and blackish, like the grounds of Coffee, which is called the black vomit."

"No. 9.—There is often pain and heat without swelling at the Pit of the Stomach, which ascends up the Oesophagus and is a sure indication of the approach of the black or bloody vomiting, which generally continues to the end" (epigastric tenderness again).

"No. 10.—The sick in general complain of Thirst" (an important symptom).

"No. 11.—The Distemper began at first solely in that Quarter or District of the Town called Gamora ? [Cartagena] being that of the Piscadores (or Fishermen) near the City Gate, in the Street of Conception and in the House of Juan Moncerratto. The other parts of the Town when the Disease began being most healthy, there being only a few Intermittent Fevers."

"No. 12.—Those who have returned from the Country and have been

taken ill there after quitting the Town say that they began to feel indisposed from the second to the sixth day after leaving the City." (See Incubation period.)

"No. 13.—Where one Person of a Family is taken ill, the rest frequently fall sick one after another in 3 or 4 or 5 days."

"No. 14.—In general the Pulse is full and strong at the beginning, which suddenly on the third or fourth Day or at the furthest on the 5th Day becomes weak and from 90 to 100 falls to 60 *and sometimes* 30 *or* 40;[1] in this state the Patients remain without any preternatural heat or cold on the surface of the Body and then expire commonly with black or bloody vomiting or in the act of a Diarrhœa of the same kind. Others die with convulsions and some expire quite suddenly without any of these symptoms or without any change of the natural colour." (All most excellent: note that Faget's sign is in part recognized.)

"No. 15.—It is exactly the same desolating Distemper as that experienced at Philadelphia (described by Isaac Catral) and is the same Disease which I witnessed at Seville in 1800, called the Malady of Sians [sic] by the French or more commonly the Yellow Fever.

"With which I reply to the Questions put by the aforesaid Physician of Gibraltar, Camp at St. José, 8th October, 1804.

(Signed) MIGUEL CABANELLOS."

Dr. Cabanellos completely justifies in this document the high estimation in which as a physician he was held in Spain. His replies are evidence of the possession of a remarkable clinical insight; indeed after reading them one feels that if they had been founded on observations made during the Gibraltar epidemic its nature could not have admitted of any further doubt.

YELLOW FEVER IN SPAIN.

1793—1804.

The presence of yellow fever in Spain at the period with which we are dealing is a well-known fact, mentioned in every textbook. It was first reported in Europe at Cadiz in 1700, and Cadiz was the headquarters of the West Indian trade, and it was probably by the ships engaged in that trade that the infected mosquitoes were brought to Spain. For a time it remained upon the coast, but at a later period, 1793 to 1805, and still later its area increased and its virulence became greatly intensified. Seville, Murcia, Jumila, Malaga, Cartagena, Barcelona and Palma were all the seat of severe epidemics.

INTRODUCTION OF YELLOW FEVER INTO GIBRALTAR IN 1804.

We are now in a position to endeavour to trace the introduction of the disease into Gibraltar in 1804.

[1] There are no italics anywhere in the original.

The Case of the Smuggler.

"About the 10th or 12th August, 1804, a Priest named Hoyera was called by a smuggler to 'confess' a man lying in the Garden of the Public Library, who was believed to be dying. This man confessed that he had come from Malaga in a Felucca with two others and that his disorder was *like that* which prevailed at *Malaga* when they left it, but a few days before. *This man afterwards died and was buried there*" (i.e., in the Library Garden) (p. 17).

The three men who came from Malaga, smugglers all, "lived in the Library Garden or in some sheds near it, which were in every direction about Boyd's Buildings and *Santos's House*."

The man who called the priest was subsequently taken ill, but recovered. The third man was not traced.

The Case of Santos.

"On 27 August 1804, Doctor Jaye was called to visit the son of one Santos, the Keeper of a wine house in Boyd's Buildings.

"This young man had just returned (August 25th) from Cadiz, where he had been exposed to infection. On first seeing young Santos Dr. Jaye did not suppose his disease was of a communicable nature, but finding that it spread thro' the whole of Santos' Family and to several in the adjoining Houses, he shortly became convinced that it was highly so. *A few days* after Santos had been attacked, his Mother, two Aunts, one Brother and two Sisters who were living in the same House with him, were taken ill of Fever."

His mother and two aunts died *before September* 16.

The movements and medical history of Santos were as follows, although they were not ascertained until *November* 21, 1804.

"He left Gibraltar about 26th July 1804 to go to Cadiz. At Cadiz he heard that Fever had broken out at *Malaga*, upon which he proceeded about *the* 23*rd or* 24*th of August* to return to Gibraltar, and to avoid the Quarantine which he expected would be put on any vessels coming from any port of Spain he got on board a Portuguese Schooner named the Conception, which arrived at Gibraltar on 25th August, 1804 after a passage of 24 hours." (This date of arrival was later confirmed from official records.)

"Two days after his arrival (i.e., on August 27) he was seized with Fever and sent for Dr. Jaye. He heard of no sickness at Cadiz when he left it, but confessed he was in one room with a man *who was lying ill as he believes of Fever*. That the house was a Tavern where he had gone accidentally to get something to drink, that he did not know who the person in Bed was."

The Case of Pratt.

On *March* 8, 1805, it was discovered that "a Person named Pratt had arrived in the garrison who had been ill of a Fever whilst living in the *same House with young Santos at Cadiz in* 1804."

Pratt was a Master Cooper of the Navy Victualling Yard and was examined on oath on March 9, 1805, before the Lieutenant-Governor.

The substance of his evidence was as follows :—

"He left Gibraltar about July 30, 1804 intending to go to Cadiz. He went in a Boat to Algeziras and thence by land. He arrived at Cadiz on the *3rd or 4th of August.* He lodged in the Tavern Del Sol, in the street Handillo, where he remained about 15 *or* 16 *days, when he was taken ill* and having continued ill for 8 days, he had symptoms *of a black or bloody vomiting*: at this he was much alarmed and for fear of being sent to the Hospital he removed to another quarter of the Town and ultimately recovered. He had however a very yellow look which prevented the Master of a Vessel from taking him on board and bringing him to Gibraltar, as it might be the means of putting the Vessel into Quarantine."

It appears that a privateer captain living in the same tavern with Pratt was taken ill at the same time as himself, with the same symptoms, and was removed to hospital where he died.

Pratt also stated that "a Gibraltar man named *Santos lived for many days in the same Tavern with him,* whilst he was ill of a Fever, which, however *he endeavoured to conceal* for fear (as already stated) of being compelled to go to a Hospital; that Santos returned to Gibraltar in the Vessel in which he (Pratt) had been refused a Passage."

"He was told that the Disorder generally attacked strangers and was fatal to them. That he was attended when he removed from the Tavern by a Man to whom he gave some of his clothes and this Man shortly after receiving or wearing them was taken ill and died."

The Cases of Pratt, Santos and the Smuggler.

The point at issue is now narrowed down to the cases of (1) Pratt, (2) Santos, and (3) the Smuggler, but before stating the conclusion it may be useful to show how it has been reached, as it is the method which must be followed in every investigation of the kind. Moreover, quite recently I have had to endeavour to unravel by similar means the story of an outbreak of yellow fever in a British Colony, when both the nature of the disease and the method of its introduction were in dispute.

Constants in Yellow Fever.

In yellow fever there are certain "constants," which although not absolute are nearly so, and no conclusion can be accepted which seriously encounters any one of them.

The Mosquito.

		Period
1.	From the infection of the mosquito to the possible conveyance by it of the disease to man	12 days.
2.	Duration of life of *Stegomyia calopus* ...	About 30 days.
3.	Number of batches of eggs laid, 7.	
4.	Eggs laid after the 12-day period are infected and can transmit the disease to a second generation of Stegomyia.	
5.	After hatching as imagines these become capable of conveying infection in ...	14 days.

Man.

			Incubation period
1.	From date of infection to appearance of symptoms (incubation period)	Experiments	2 days 20 hours to 6 days 2 hours.
		Clinical (Carter)	3 days to $5\frac{3}{4}$ days.
		Inoculation of blood serum	(?) 12 days.
		Average ...	5 days.
2.	Duration of infectivity to a mosquito, i.e., the patient must be bitten within		The first three days of the illness.

ANALYSIS OF CASES AND COMMENTARIES.

CASE OF PRATT.

Analysis.

Nature of disease	Yellow fever.
Date of infection	Doubtful.
Place of infection	Cadiz, Tavern Del Sol.
Onset of illness...	August 18 or 19.
Incubation period	Doubtful.
Day of landing at Gibraltar ...	Doubtful, but later than August 25.
Result	Recovered.

Commentary.

Pratt was almost certainly the man whom Santos saw lying in bed with fever at Cadiz. Pratt and Santos were both infected in the same tavern at Cadiz. Santos came to Gibraltar in the boat which had refused to take Pratt, because he looked yellow.

The Case of Santos.

Analysis.

Date of infection	Before August 24.
Place of infection	Cadiz, Tavern Del Sol.
Onset of illness...	August 27.
Incubation period	Probably about five days.
Day of landing at Gibraltar ...	August 25.
Interval between arrival at home and appearance of second case in father's house	"A few days."
Result in second case (mother) ...	Death.
Date of death (mother)	"Before September 16."
Result (Santos)...	Recovered.

Commentary.

At first sight it appears almost certain that the disease was brought to Gibraltar by Santos, and that was the view which was adopted. But if there were no infected Stegomyia in the tavern kept by the father of Santos at the time of his son's arrival on August 25, and if he was bitten between August 27 and August 29 (the first three days of his illness) the earliest day on which the second case could appear in Santos' house, or in visitors, would be about September 7 (twelve days). We are told that "a few days after Santos had been attacked" his mother "fell ill."

If an interval of twelve or thirteen days had elapsed between the onset of his illness and the appearance of the second and other cases it is unlikely that the words "a few days" would have been used or that it would have been stated that Dr. Jaye "shortly became convinced" that he was dealing with a highly communicable disease.

"On the 6th September Mrs. Fenton wife of a Bombardier in the Royal Artillery who was in the habit of visiting the Santos was taken ill. She died on September 8th. The Bombardier also died on the 8th Septr. [p. 30]; on the 9th the Daughter of the keeper of the Canteen of De Rolls Regiment who inhabited the house adjoining Santos, to the northwards was infected; she died on Septr. 15th and a soldier of De Rolls Regiment on the 11th. The Disease was thus first introduced into that Regiment and amongst such soldiers and their wives of the Royal Artillery as had communicated with Fenton and his wife whilst all the other corps continued healthy."

Case of the Smuggler.

Analysis.

Nature of disease	Yellow fever.
Date of infection	Doubtful.
Place of infection	Malaga.

Onset of illness	Doubtful, probably about the beginning of August.
Incubation period	Doubtful.
Date of arrival at Gibraltar ...	"A few days before August 10th or 12th."
Date of death	Probably August 10 or 12.

Commentary.

The Priest Hoyera who "confessed" the dying smuggler informed a friend, Mr. Breciano, "some time after the event" confidentially, that the dying man "had all the symptoms upon him of the Disorder which he had seen at Lebrija, a small town in the neighbourhood of *Seville* in 1800 where it had been very fatal."

"Neither Breciano nor Hoyera divulged this fact at the time, for they were unwilling to alarm the garrison, and it was not until Santos's illness and when the Disease began to appear about Boyd's Buildings that they both expressed publicly their suspicions of the nature of the Fever in Gibraltar" (p. 18).

"It had been said that there were some Sick in the part of the Town (Boyd's Buildings and Santos's House) and *even one or two deaths* previous to the Alarm which Santos's Illness occasioned, but they were attributed to the Warmth of the Season, and *even after the Disorder* appeared at Santos's House no attempts were made to trace it to any other source; as the circumstances of his arrival from Cadiz, his sickness immediately afterwards, and the progress of the disease in his Family were sufficiently well ascertained to account for all the mischief which ensued" (p. 18).

"As the three smugglers from Malaga lived in the Library Garden, and as the one who died was buried there, it is reasonable to conclude that the Disorder did not spread from him *which it might otherwise have done* [italics not in report] had he lived in a confined or crowded house, as was the case with Santos" (p. 17).

This proviso, in the light of present-day knowledge, is of course not at all necessary.

"Again, it appears by the concurring testimony of all the Town's Practitioners that no case of Fever occurred which was remarkable until the 27th August, when there existed only 14 Febrile cases in the *Military Hospitals*."

Local practitioners, in my experience, are in no hurry to diagnose yellow fever.

Conclusion.

The following facts appear to emerge as proven from this rather minute and possibly tedious analysis:—

(1) That the first case of yellow fever in Gibraltar in 1804, of which we have any certain knowledge, occurred in the smuggler, who died about August 10 or 12.

(2) That this man lived in the neighbourhood of a tavern (Santos's house).

(3) That Santos, the son of the tavern keeper, arrived home on August 25, about fourteen days after the death of the smuggler, he being then in the incubation stage of an attack of yellow fever acquired in Cadiz.

(4) That he was taken ill two days after his arrival, and that *a few days* after the onset of his illness other cases appeared in that house, and that ultimately six persons were infected, and that persons visiting this tavern became infected and that one, Mrs. Fenton, was taken ill on September 6 and died on September 8.

Allowing for an incubation period of only three days, it would appear that Mrs. Fenton was infected on or about September 3.

If the Stegomyia in Santos's house are assumed to have first acquired infection from biting Santos on August 27, the first day of his illness, they would not become capable of infecting other persons until September 7, i.e., *one day after the onset of Mrs. Fenton's illness and one day before her death.*

It is obvious that if, in the case of Mrs. Fenton, a longer incubation period is assumed, say one of five days, the argument is strengthened.

The case of Mrs. Fenton is important, as it is the only one, except that of Santos, in which the precise date of the onset of the illness is stated. In other cases the words used are "a few days" and "shortly."

It is to be remembered that Santos's father's house was a tavern and presumably a place of public resort.

If the Stegomyia in that house were infected before the arrival of Santos from Cadiz, the appearance of other cases "a few days" subsequently presents no difficulties.

My conclusion, therefore, is that, if we assume that the earliest cases of the epidemic of yellow fever in Gibraltar in 1804 are known to us, *the disease was introduced by the smuggler.*

It is, however, very rarely when the more careful investigation is made later, as it was in this case in 1805, that the earliest cases are discovered. I should attach more importance to the fact that previous deaths in the part of the town where Santos lived were recalled, *after his illness declared itself*, than to the statement that there were only a few febrile cases at the time in the military hospitals.

The disease in this case began amongst the civilian population and spread to the garrison.

Incidence and Mortality.

The Garrison.

On September 11, the day on which the first soldier died, the strength of the garrison appears to have been 4,052.

"The following Official Account was inserted in the Gibraltar Chronicle on the 23rd March (1805), this was sent to the editor from Head Quarters.

"Died of the Fever in the Garrison of Gibraltar from its first appearance in the beginning of September (1804) to the total extinction in the latter days of December.

Officers	54
Soldiers	864
Do. wives and children	164
Inhabitants	4864
Total ...	5946."

The report of Dr. Fraser contains the following statement :—

"The Statement of the Mortality amongst the military is nearly correct, of course, but amongst the Inhabitants the Deaths are probably exaggerated."

It is not possible to give with any degree of accuracy the total number of the sick amongst the garrison.

Civilian Population.

The incidence of the disease can only be surmised, as the total civilian population is not given, but it is stated that it was nearly the same as Algeziras, which was about 9,000.

After the epidemic ceased "only 28 adults could be discovered who had resided with in the walls who had escaped the Malady."

CONTAGIONISTS AND ANTI-CONTAGIONISTS.

From reading many reports, such as this, I have come to regard the occurrence of a violent and acrimonious contention amongst the medical men concerned, when the nature of the disease is in doubt, as the most certain evidence of its being yellow fever!

It hardly ever reaches such a degree of virulence in relation to any other disease.

It is recorded that at a meeting of the Medical Staff held on September 15 by order of the Governor:—

"The jarring opinions of the medical conclave which occurred on this occasion might be esteemed the Exertions of intellectual Gladiators contending for Victory rather than truth."

After all it was quite natural: there was so much to be said on both sides. Take for example the case of Santos's house. Who but a person as stupid as a donkey or as obstinate as a mule could be found to deny that the disease therein was "contagious"?

But consider, on the other side, the case of a man suffering from yellow fever who was admitted into a hospital ward (where there were no Stegomyia!), and yet the disease did not spread. What a triumph for the anti-contagionists! I hope that if I had lived in those days I should have been a "contagionist," as was Surgeon Major Pym, afterwards a great authority on the subject of yellow fever.

We should no doubt have been wrong, but the measures we should have advocated might have stopped the epidemic, and often did so, whereas the anti-contagionists, who alas! "included the Heads of the Departments (both naval and military)" "used the most convincing arguments to quiet the minds of the people and to assure them that it was not infectious—that it originated from the Easterly Winds—the heat of the weather—the Filth of the Town—and the burning of Lime Kilns and that it would certainly disappear with the change of the Wind and the setting in of the rainy Season."

Pym as already stated arrived on October 18 and immediately called for a return "of such of the troops as had been afflicted with the Disease in the West Indies and in the Queen's and 13th Regiments, he received a list of 83 men who had had it *every one of whom had escaped an attack of Fever here*, which was a convincing proof to him of the identity of this Disease with the Malignant Pestilential Fever, as Chisholm had remarked that no one was a second time subject to it."

Pym then "wrote to the Board of Health in London and mentioned his Plan of putting a stop to the Disease," and it was a very sound one, but it is too long to give here. In it he mentioned that "at a meeting of the medical men on the 15th September, before his arrival there was only one person, Mr. Kenning, of the Royal Artillery, who ventured to pronounce the Disease infectious, in consequence of which there was not the smallest Precaution taken to prevent its spreading."

Pym saw Sir Thos. Trigge, but "Sir Thomas received the propositions coldly," but he allowed him to put them before the Commanding Officers "who accordingly assembled and were so fully convinced of the Truth and Justice of Mr. Pym's Statement that they resolved to carry them (except one) into effect in their own Corps."

But the last proposal of "taking the Guards by Detachments of Men who had passed the Fever and placing those who had not in Quarantine, could only be effected by Sir Thomas, and Pym could never persuade him to this step."

I take off my hat to Surgeon Major Pym!

"Immediately after the contagion ceased the Garrison became uncommonly healthy, the Disease was neither preceded nor followed by any other Disorder and those who had lived secluded enjoyed perfect health."

ALGEZIRAS.

The disease appeared at Algeziras towards the end of October and the Spanish Governor Castanas at once took the most energetic measures to arrest its progress, and with great success.

"Here we have an example of two Cities very nearly of the same extent and Population situated on opposite sides of the same Bay, only six miles asunder, where the same disease breaks out in both of them at the same season. In the one by the advice of the Faculty precautions are totally

neglected the most horrible Scenes of Calamity follow and between 5 and 6000 persons are destroyed. In the other the Faculty are not consulted vigorous measures are adopted and very little loss ensues"!!

Colonel Wright says, "the Military are the only safe and effectual Practitioners in checking the progress of Contagion"!!

I am now more confident than ever that the Report is all "Wright."

YELLOW FEVER IN THE MEDITERRANEAN COLONIES.

Apart from my general interest in yellow fever, I was anxious to assure myself whether or no in times past it had really been in our Mediterranean colonies, as they lie nearer to Europe than those in West Africa, with the history of which in this relation I am well acquainted. Of late in high quarters (not in this country), doubt has been thrown on the conclusions of the Yellow Fever Commission, as to the presence of that disease in the West African colonies, both in the past and at the present day. On neither of these points am I troubled with any doubt whatever, and I am rather at a loss to understand how it has arisen. In drafting the Second Report of the Commission which dealt with the history of those colonies in relation to this disease, and particularly with the effect of the slave trade on the dissemination of yellow fever (which was apparently *nil*) I obtained from various sources, including surgeons' logs of the ships of the British Navy engaged in the suppression of the slave trade, for which search the records in the Admiralty Library were kindly placed at my disposal, evidence which is therein set forth which proved conclusively to my mind the presence of the disease on the West African coast.

In 1778[1] "Yellow Fever was well established in Senegal"; it had certainly been there for many years, probably for many centuries previously, and I believe that it has been there ever since then and that it is there to-day.

"Yellow Fever[2] may have been brought to the Canary Islands in 1494 by the Spanish vessels" which returned to Spain after having landed Don Bartolome Colon at Ysabella San Domingo, "and it is possible that the great pestilence which visited the Island of Teneriffe in 1495, which was believed to have been introduced in a similar manner, may have been Yellow Fever." Now we are sure that it was at Gibraltar in 1804.

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[1] "A Treatise of the Synochus Atrabiliosa," by J. P. Schotte, M.D. (London, 1782).

[2] Yellow Fever Commission (West Africa), Second Report, p. 7.

REPORT ON EXPERIMENTAL WORK CARRIED OUT AT THE ARMY SCHOOL OF HYGIENE TO DEMONSTRATE THAT CHLORINE GAS IN ASSOCIATION WITH AMMONIA GAS IS A MORE EFFICIENT STERILIZER OF WATER THAN CHLORINE GAS USED ALONE OR CHLOROS OR BLEACHING POWDER.[1]

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The provision of adequate water supply is a constantly recurring problem, both in civil and military life. Even with the knowledge of the probable numbers to be supplied and their location, municipalities with rapidly increasing populations are in places experiencing great difficulty in meeting these demands.

In civil life ample time exists for making a careful selection of the source, and when found the immediate delivery of the water may not be essential. Preliminary treatment by storage, or any other method of proved value whereby the colloid and bacterial content of the water is materially reduced, may be carried out at leisure, and all stages and details of the final purification controlled by well-equipped laboratories.

If the problem in civil life is beset with difficulties, how much more complex does it become in military undertakings, in which the number of troops to be employed and their permanent location cannot be foreseen. The immediate consumption of the rapidly treated water is the rule, and the selection of the source of supply is entirely dominated by the military situation. During the war our armies scattered over the globe were simultaneously drawing water from the sea (condensed), from rivers, canals, wells, bores, shell-holes, village tanks in India, and even from impounded road and surface washings which in many Persian villages constitute the water supply.

On numerous occasions it required the concentrated efforts of all to procure the requisite amount of fluid per man necessary to sustain life, and this, although not pure water, was so treated that deleterious after-effects did not follow its ingestion. The efficacy of the measures adopted, which are capable of almost universal application, was reflected in the relatively small amount of water-borne disease; and the enormous saving in life which resulted will for ever stand as a monument to the memory of the

[1] Read before the Navy, Army and Air Force Group of the Society of Medical Officers of Health, February 1, 1924.

master minds responsible for the evolution of these simple and effective processes of purification.

The standard mode of treatment in the Army has been tersely described as Clarification by Alum followed by Sterilization by Chlorine, and this investigation was not commenced with the object of detracting from the value of these proved and accepted measures, but to elucidate certain anomalous results met with in practice which have appeared inexplicable. Some of these are here briefly recounted for the benefit of officers of the Royal Army Medical Corps, who may at any time be faced with similar conditions. It may be opportunely pointed out that heavily polluted waters are rarely used, except under war conditions, and even then only in cases of dire necessity. It is just at these times that it is frequently impracticable to carry out complete bacteriological analyses, and much valuable information has probably been lost.

In the cold weather of 1916-1917 an Artillery Practice Camp was opened up at Hoshiarpur in the Punjab. The camp was sited on a porous sandy soil between mango groves, the country around was largely covered with pampas grass intersected by Chohs.[1] The subsoil water level was high, being in many places only three feet below the surface. Dotted about were Indian hamlets each surrounded by a patch of heavily manured agricultural land. The sanitation of these small villages was of the usual rural Indian type, i.e., non-existent.

Horses were watered in the Chohs at shallow excavations lined with wood or sheet iron, and drinking water was drawn from existing unsteined shallow wells.

The water was clear, required no preliminary sedimentation, had a good odour, a faint brownish tint, and a very slight brownish peaty deposit separated out on prolonged standing. Analysis of the water revealed a high albuminoid ammonia content and the presence of an excessive number of polluting organisms. It was laid down that all water was to be chlorinated by means of the Beyt's field chlorinators supplied. Samples of this treated water, in which ample free chlorine had been demonstrated by starch and KI, still showed the presence of lactose fractors, and an increase in the amount of chlorine used was insisted on. Sterility was obtained, but the taste of the water was bad, and complaints from the troops were loud and long. Later, the use of untreated water for making tea, and boiled and cooled water for the regimental soda water factory was authorized.

At a later date chlorogen, a proprietary hypochlorite, was experimented with and gave good results. A large bore tube-well, the future water supply of Lahore Cantonment, had become polluted by leakage into it of foul subsoil water from a sump in which coolies had been working. A sample of the same bulk chlorogen was used to sterilize the contents of

[1] Local name for a dry river bed.

the well, and sterility could only be obtained after making two attempts and using chlorogen far in excess of the quantities recommended. The presence of free chlorine in excess of natural deviation was demonstrated on both occasions. Later, the same bulk chlorogen was used in normal strength for sterilizing water in an irrigation well in the station hospital compound and proved effective.

After these experiences in the inter-brigade manœuvres between Lahore and Jullundar Brigades bleaching powder was recommended. The Senior Medical Officer, Lahore Brigade, returned his supply received from Medical Stores as being useless, and on analysis the bleaching powder was found to have an available chlorine content of less than five per cent. The Brigades were then issued with Beyt's field chlorinator sets, which were well reported on by the Senior Medical Officer, Lahore Brigade, and subsequently they were found to be extremely useful on the lines of communication, East Persia.

In France the effluents delivered by sterilizing lorries working on certain canals were unsatisfactory unless preliminary sedimentation with alum was carried out, whereby a considerable reduction in the amount of clay, bacterial, and colloid content of the water was effected.

Recently two sterilizing lorries in perfect mechanical order were tested at Middlesex Wharf, London, under the supervision of Major S. Elliott, B.Sc., Instructor in Chemistry at the Royal Army Medical College, to whom I am indebted for the following details :—

Date	Lorry No.	Delivery per hour	Sand filter pressure in lb.	Clarity of effluent	Chlorine in effluent Parts per million	Horrocks' absorption Parts per million	Remarks
18.10.22	10774	1,200	4 lb.	Good	5·5	2	Effluent non-sterile lactose fractors present
18.10.22	10791	1,320	6 lb.	,,	2·2	2	do.
25.10.22	10774	1,200	4 lb.	,,	8·0	2	do.
25.10.22	10791	1,440	8 lb.	,,	4·9	2	do.

It will be seen from the above that these lorries were working in pairs on the same dates, the quality of the effluent delivered by each is comparable and the amounts of free chlorine in the effluents are considerable.

It should be clearly understood that the water at Middlesex Wharf is grossly polluted and on these occasions the standard procedure was not adhered to. In the lorries no coagulant was used and the water was clarified by rapid filtration through the Silex roughing filter only without the formation of an alumina hydrate film.

The following series of experiments were commenced in November, 1922, at the Army School of Hygiene, Aldershot, and the investigation was planned to include :—

(1) An inquiry into the action of chlorine and some of its compounds in water with certain degrees and types of pollution.

(2) To compare the killing powers of these chemical agents and the resistance of various excremental organisms.

(3) To see if any simple improvements could be effected.

(4) The vexed question of taste was to receive special attention.

The organisms used in the experiments were subcultures from the National Collection of Type Cultures, Lister Institute, and comprised :—

Vibrio choleræ (Liston)	= V.c.
B. typhosus (Howard)	= B.t.
B. dysenteriæ (Flexner *v.* Oxford)	= B.d.
B. enteritidis (Gaertner)	= B.g.
B. suipestifer (Mutton)	= B.a.

The pathogenicity of these organisms was not raised by passage through animals in order that their resistance to killing might not be impaired.

Experiment No. 1.—To find the amount of chlorine deviated when added as b.p.* solution and allowed forty-five minutes' contact. Amount of chlorine added = five parts per million.

Results throughout expressed in parts per million	Chlorine remaining (without acid)	Deviation (by difference)	Chlorine remaining (with acid)	Deviation†
0·5 c.c. B.a. broth culture added to 200 c.c. tap water	1·9	3·1	3·2	1·8
Do. B.g. do. do.	3·0	2·0	3·0	2·0
Do. B.t. do. do.	2·5	2·5	2·8	2·2
Do. V.c. do. do.	1·9	3·1	3·0	2·0
Do. B.d. do. do.	1·8	3·2	2·6	2·4
			Average	2·0

* b.p. signifies bleaching powder.

† These figures are taken as true deviations. It will be seen that without the addition of acid, in the final thio-sulphate titrations a higher deviation is recorded, and the figures are not nearly so constant. See also Experiment 11.

Estimation of the Killing Power of b.p. Solution in Varying Strengths.

Amount of chlorine added as b.p. solution in parts per million	8	6	4	3
		(Result on plating out 1 c.c.)		
0·5 c.c. broth culture B.t. in 200 c.c. autoclaved tap water	—	++	+++	+++
Do. B.d. do. do.	+	+++	+++	+++
Do. B.a. do. do.	++	+++	+++	+++
Do. B.g. do. do.	—	+	+++	+++
Do. V.c. do. do.	—	—	—	—
Average amount of chlorine in excess	6·3	4·5	2·9	2·0
Average amount of chlorine deviated	1·7	1·5	1·1	1·0

The experiment shows that with relatively large excess of chlorine the organisms are not destroyed. A gradation of killing power is indicated by the number of colonies obtained on plating out one cubic centimetre of water, and is seen to vary with the species of organism.

Mass action affects the amount of chlorine deviated, e.g., with 8 parts per million 1·7 parts are deviated, with 3 parts per million 1 part is deviated.

Note : + indicates relative number of colonies obtained, and — indicates sterility.

EXPERIMENT No. 2.—Deviation only.—Reduction of broth culture to one-half. Amount of chlorine added as b.p. solution = 2 parts per million.

	True deviation in parts per million
0·25 c.c. broth culture B.d. to 200 c.c. autoclaved tap water	0·8
,, ,, ,, V.c. ,, ,, ,, . ..	0·9
,, ,, ,, B.g. ,, ,, ,, ...	0·9
,, ,, ,, B.a. ,, ,, ,, ...	0·8
,, ,, ,, B.t. ,, ,, ,, ...	0·85
Average ..	0·85
200 c.c. tap water alone with 1 part per million chlorine added	0·55
,, ,, ,, 2 parts ,, ,, ,, ...	1·15

The addition of 0·25 c.c. broth culture to 200 c.c. of tap water appears to cause a decrease in the amount of chlorine deviated by it.

Killing Power and Deviation.

Amount of chlorine as b.p. solution added in parts per million	6·85	4·85	2·85	1·85
		(Result on plating out 1 c.c.)		
0·25 c.c. broth culture B.t. to 200 c.c. autoclaved tap water	—	—	++	+++
Do. B.d. do. do.	—	—	+++	+++
Do. B.a. do. do.	—	—	+	+++
Do. B.g. do. do.	—	—	—	+++
Do. V.c. do. do.	—	—	—	—
Average true deviation ..	2·7	2·2	0·85	0·85

(Cf. Experiment No. 1.) By reducing the amount of broth culture in the autoclaved tap water from 0·5 cubic centimetre to 0·25 cubic centimetre the deviation of chlorine is increased, and a greater killing power is obtained. It would appear, therefore, that a definite inhibition takes place in the higher concentrations of broth culture.

EXPERIMENT No. 3.—Deviation only.—Further reduction of broth culture to one-fifth of amount in Experiment No. 1.

Amount of chlorine as b.p. solution, two parts per million	True deviation
0·1 c.c. broth culture B.d. to 200 c.c. autoclaved tap water	0·45
Do. do. B.t. do. do. do.	0·70
Do. do. V.c. do. do. do.	0·45
Do. do. B.g. do. do. do.	0·45
Do. do. B.a. do. do. do.	0·40
Tap water alone with 1 part per million chlorine added	0·65
Do. do. 2 parts do. do.	0·90

It will again be seen that the addition of broth culture to water affects the chlorine deviation in a peculiar manner, depending to some extent upon the amount added.

Killing Power and Deviation.

Amount of chlorine added as b.p. solution in parts per million	1·45		2·45	
	True deviation	Result on plating out	True deviation	Result on plating out
0·1 cc. broth culture B.t. to 200 c.c.	0·50	1 colony	1·10	—
autoclaved tap water	0·45	—	0·85	—
Do. V.c. do. do.	0·50	+++	0·65	Reduced to 1/10th of number on previous plate
Do. B.a. do. do.				
Do. B.g. do. do.	0·60	+++	0·85	Do. do.
Do. B.d. do. do.	0·50	+++	0·70	—

Again, it will be seen that by decreasing the amount of broth culture the killing power is increased. The organisms may apparently be placed in the following order according to their resistance to killing :—

(1) B.a. (2) B.g. (3) B.d. (4) B.t. (5) V.c.

The deviation of chlorine appears to offer a better guide to the killing power than the actual amount of excess chlorine remaining: in other words, where inhibition plays a part the relative deviation is low, and the excess of chlorine in such cases must be very large indeed to overcome this resistance.

In order to discover the factors responsible for the variations in the deviations (in Experiment 4), varying quantities of broth and broth cultures were treated with a constant amount of chlorine, using three parts per million of b.p. solution.

Experiment No. 4(*a*).—Deviation only.

The figures given in these tables are the amounts of chlorine taken up after forty-five minutes contact. Amount of chlorine used throughout as b.p. solution = three parts per million.

Amounts of broth or broth culture added to 200 c.c. tap water	0·1 c.c.	0·25	0·5	1·0
Organism		Deviations		
B.t.	0·9	0·4	0·6	0·6
V.c.	0·4	0·2	0·2	0·8
B.a.	0·5	0·5	0·4	0·9
B.g.	1·0	0·8	0·8	0·8
B.d.	0·8	0·4	0·7	1·0
Broth alone		1·0	1·1	1·5

Experiment No. 4(*b*).

Cultures arranged in order of density of growth :—

B.a. (heavy)	0·8	0·8	0·85
B.g. (medium)	0·85	0·5	0·55
B.t. (light)	0·90	0·45	0·5
Broth alone	0·70	0·4	0·4

Experiment No. 4(*c*).

Broth alone	0·85	0·5	0·5	
* B.d. (light)	0·75	0·45	0·5	0·95
B.g. (medium light)	0·5	0·55		
V.c. (medium)	0·75	0·45	0·65	0·95
B.t. (heavy medium)	0·95	0·6	0·6	0·95
* B.a. (heavy)	0·65	0·5	0·9	0·8

* B.a. reduced with broth to the opacity of B.d.

Experiment No. 4(*d*).

Broth alone	0·7	0·45	0·5	1·1
B.a. Standard opacity 1,000 mill. per c.c.	0·7	0·6		1·2
B.g. ,, ,, ,,	0·75	0·5	0·45	0·7

From these figures it will be seen that the species of organism used has no influence upon the amount of chlorine deviated. The variations depend largely on the amount of broth or broth culture present. Ordinary

broth produces the same effect as broth culture, unless the growth is exceptionally heavy when the drop in deviation in columns 2 and 3 is not marked.

With 0·1 cubic centimetre of broth or broth culture (opacity not exceeding 1,000 millions per cubic centimetre), the deviation of chlorine corresponds closely or is rather less than that of raw water. With 0·25 or 0·5 cubic centimetre, the deviations of which are almost uniformly equal, there is a definite decrease, and with 1 cubic centimetre and upwards the deviation is increased beyond that of water.

Experiment No. 5.—Deviation only.

The following deviation tests were carried out with cultures grown on agar, and suspended in water:—

	Standard opacity 1,000 millions per c.c. 1 part per million Chlorine as b.p. solution	2 parts per million Chlorine as b.p. solution
V.c. 0.5 c.c. suspension to 200 c.c. autoclaved tap water	0·55	0·70
B.t. do. do. do.	0·4	0·50
B.d. do. do. do.	0·7	0·80
B.g. do. do. do.	0·7	0·9
B.a. do. do. do.	0·55	1·0

Killing Power and Deviation.

Amount of chlorine added as B.p. solution :	3 parts per million Free chlorine	True deviation	4 parts per million Free chlorine	True deviation
V.c. 0·5 c.c. of watery suspension to 200 c.c. autoclaved tap water	2·15	0·85	2·5	1·5
B.t. do. do. do.	1·95	1·05	1·85	2·15
B.d. do. do. do.	1·95	1·05	2·6	1·4
B.g. do. do. do.	1·90	1·1	2·6	1·4
B.a. do. do. do.	1·65	1·35	2·65	1·35

Result on plating out 1 c.c. after 45 minutes contact = all organisms killed.

The chlorine deviation with cultures grown on agar and suspended in water is very similar to that of the raw water, increasing with the amount of chlorine added.

It will be seen that the organisms are killed much more readily than when grown in broth. The resistance of broth cultures to killing may be due to an increase in the virility of the organisms resulting from their growth in broth, or the colloids contained in the broth may afford protection even in a dilution of 1 in 2,000 of tap water.

Experiment No. 6.—Deviation and Killing Power.

A = titrated without acid. B = titrated with acid.

Amount of chlorine added as b.p. solution in parts per million :	1		2		3		4	
	Deviation of chlorine in parts per million							
	A	B	A	B	A	B	A	B
B.a. 0·1 c.c. broth culture in 200 c.c. autoclaved tap water	0·70	0·45	1·35	1·05	1·90	1·25	2·15	1·50
B.a. cultures grown on agar suspended in broth made up to same opacity as above (1,000 millions per c.c.). 0·1 c.c. of this suspension in 200 c.c. autoclaved tap water	0·45	0·35	1·20	0·90	1·50	1·00	2·05	1·25
Result on plating out	++	++	++	++		–		–

With suspensions of organisms of like opacity the deviation of chlorine is comparable both in the case of broth cultures and with agar culture suspended in broth. Their resistances to killing are also similar (*vide* Experiments No. 3 and No. 5). In other words the increased resistance to killing is not due to enhanced virility resulting from growing organisms in broth, but due to the presence of the broth interfering with the lethal action.

EXPERIMENT No. 7.—Deviation and Killing Power.

	Chlorine added as b.p. solution in parts per million	Chlorine deviated A	Chlorine deviated B	Chlorine excess remaining	Result on plating out
1 c.c. of watery suspension of B.a. grown on agar (standard opacity 1,000 millions per c.c.) added to 200 c.c. of tap water	0·5	0·43	0·33	0·17	++++
	0·75	0·5	0·35	0·4	++++
	1·0	0·65	0·45	0·55	++++
	1·25	0·85	0·5	0·75	+++
	1·5	0·95	0·6	0·9	+++
	2·0	0·95	0·75	1·25	+++
0·5 c.c. do. do. do.	0·25	all	0·2	0·05	++++
	0·5	0·43	0·35	0·15	++++
	0·75	0·45	0·38	0·37	++++
	1·0	0·65	0·4	0·6	++++
	1·25	0·85	0·55	0·7	++
	1·5	1·0	0·58	0·92	++
0·1 c.c. do. do. do.	0·25	all	all	nil	++++
	0·5	0·45	0·33	0·17	++++
	0·75	0·68	0·48	0·27	++++
	1·0	0·8	0·6	0·4	+
	1·25	1·08	0·78	0·47	1 colony negative
	1·5	1·3	0·95	0·55	—

"B" and "A," as mentioned previously, correspond respectively to whether the titration for excess of chlorine has been made with or without the addition of acid.

This test shows that with large numbers of organisms, even when suspended in water, inhibition is evident in the higher concentrations. It will be seen that the amount of chlorine in excess is no guide to the lethal action.

N.B.—A comparison between the apparent deviation of chlorine and the true deviation as found by the addition of acid is interesting when compared with the killing power.

EXPERIMENT No. 8.—In this and subsequent experiments B.a. alone was used as our test organism in order to reduce the amount of work to a minimum. B.a. was selected because it had been previously proved to be the most resistant species of excremental pathogen.

To find the Deviation and Killing Power of Chlorine against B.a. in Fæcal Pollution.

One gramme of fæces was emulsified in a litre of autoclaved tap water filtered through coarse filter paper and dilutions made from this. 0·1 cubic centimetre of a B.a. culture grown on agar, suspended in water (standard

opacity 1,000 millions per cubic centimetre) was added to each 200 cubic centimetres flask.

Chlorine added as b.p. solution in parts per million	1	2	3	4	5	6	8
Fæcal pollution—							
1 in 1,000 (as above stock solution). Deviation		All		3·1		3·7	4·5
On plating out 1 c.c.		++++		++		+	+
1 in 5,000 (dilution 1 in 5 of above). Deviation		1·0	1·3	1·5	2·15		
On plating out 1 c.c.		+++	++	—	—		
1 in 10,000 (dilution 1 in 10 of above). Deviation	0·6	0·9	1·4	1·9			
On plating out 1 c.c.	+++	+	—	—			
1 in 25,000 (dilution 1 in 25 of above). Deviation	0·5	1·05	1·3	1·45			
On plating out	+++	4 cols.	—	—			

With more concentrated fæcal contamination a definite inhibition is noticed, comparable to that occurring with broth cultures.

Experiment No. 9.—To find the deviation and killing power of chlorine as b.p. solution in water contaminated with organic matter of vegetable origin.

The water used was taken from tanks in which crushed weed had been allowed to lyse, filtered through coarse filter paper; 0·1 cubic centimetre of B.a. agar culture suspended in water (standard opacity 1,000 millions per cubic centimetre) was added to each 200-cubic centimetre flask.

Chlorine added as b.p. solution in parts per million	1		2		3		4		6	
	Amount of chlorine deviated									
	A	B	A	B	A	B	A	B	A	B
Crude liquor as above	All	All	1·7	1·7			3·15	2·75	4·3	3·15
Result on plating out 1 c.c. ..	++++		+++				+		—	
Crude liquor diluted 1 in 6	0·65	0·65	1·8	1·25	1·95	1·75	2·75	2·60		
Result on plating out 1 c.c. ..	+		+		1 col.		—			
Crude liquor diluted 1 in 10	0·7	0·7	1·25	0·75	1·75	1·25	2·25	1·75		
Result on plating out 1 c.c. ..	+		—		—		—			
Crude liquor diluted 1 in 21	0·75	0·75	1·65	1·50	2·5	2·3	3·3	3·1		
Result on plating out 1 c.c. ..	—		—		—		—			

Again inhibition is noticed in the higher concentrations. It therefore occurs in the presence of colloids in the form of broth, excess of organisms, fæcal or vegetable matter, and is an important factor which must be taken into consideration when chlorination alone is relied on to render water supplies safe for drinking purposes.

Experiment No. 10.—To find out if the addition of ammonia has any effect upon the killing power of chlorine (as b.p. solution). (*Vide* Notes following Experiment 18.)

Throughout 0·1 cubic centimetre of B.a. broth culture was added to each 200 cubic centimetres of autoclaved tap water.

	Amount of chlorine added	Amount of ammonia added	Amount of chlorine deviated (A)	(B)	Result on plating out
(A) Control (chlorine only as b.p. solution) contact 45 minutes before plating	1·5	..	0·85	0·6	++++
	2·0	..	1·4	0·95	++++
	2·5	..	..	1·25	–
	3·0	..	2·1	2·5	A few colonies
(B) Equal amount of chlorine and NH_3. Ammonia added first and allowed 15 minutes contact. Chlorine added later and half-hour contact allowed	1·5	1·5	0·6	0·5	++
	2·0	2·0	1·0	0·5	++
	2·5	2·5	1·4	0·4	+++
	3·0	3·0	1·2	0·4	++
(C) Twice the amount of NH_3 compared with chlorine added as above	0·5	1·0	0·3	0·3	+++
	0·75	1·5	0·25	0·25	+++
	1·0	2·0	0·6	0·3	++
	1·25	2·5	0·55	0·55	++
	1·5	3·0	0·7	0·4	++
(D) Three times the amount of NH_3 compared with chlorine added as above	0·5	1·5	0·35	0·3	+++
	0·75	2·25	0·45	0·35	++++
	1·0	3·0	0·75	0·4	+++
	1·25	3·75	0·85	0·4	++
	1·5	4·5	0·9	0·4	++

From these experiments it would seem that the addition of ammonia does not increase the lethal power of chlorine in the form of bleaching powder solution.

(To be continued.)

THE R.A.M.C. SERVICES OF A DIVISION ON ACTIVE SERVICE.

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Royal Army Medical Corps.

(*Continued from p.* 343.)

X.—Dispositions of the Field Ambulance of a Division for Offensive Operations on a Large Scale in Position Warfare.

We will now suppose that the offensive will begin in three or four days' time and that the divisional operation orders have been issued to all entitled to receive a copy of them. The A.D.M.S., after a careful perusal of his copy, should then write the R.A.M.C. operation orders, which before issue must be approved by the "G" and "A" branches of the divisional staff.

In these orders he will definitely state the dispositions of his field ambulances, which for the sake of clearness we shall refer to as "A," "B" and "C" field ambulances. It is to be imagined that the dispositions ordered to be completed by zero hour will be as follows:—

"A" field ambulance headquarters at the advanced dressing station.

The companies (less nursing duties and clerical personnel) in the trenches; two squads of bearers at each regimental aid post of the first infantry brigade and five squads at each of the two bearer collecting posts.

"B" field ambulance headquarters (plus nursing duty and clerical personnel of "A" field ambulance companies) at the main dressing station.

The companies (less one officer detailed for duty as O.C. divisional motor ambulance convoy) in the trenches with the second infantry brigade.

"C" field ambulance headquarters (less one hospital cook detailed for duty at the walking wounded collecting station), with equipment packed and transport ready to move at short notice, to be at zero hour at a place named in the orders and to remain there in reserve.

The companies (less one officer and nursing duty and clerical personnel detailed for duty at the walking wounded collecting station) to be in the trenches with the third infantry brigade.

The motor ambulance transport should be pooled and orders issued on the lines laid down in Section VIII.

The horsed ambulance wagons of two of the field ambulances should be detailed to work on the road allotted to the walking wounded so as to carry the more severely wounded to the collecting station. Those of the third field ambulance should be held in reserve at a place named in the operation orders. They will be required later, in the event of a successful

advance, to go forward to get into touch with any new advanced dressing station that may be formed in the captured area.

In addition, orders must be given with regard to the provision of dumps of tins full of water (petrol tins washed out with boiling water answer the purpose admirably), the stocking of the regimental aid posts with extra dressings, splints, etc., the formation of dumps of stretchers, the flagging of the route to be followed by the walking wounded by means of directing boards, etc.

The provision of an ample supply of spare stretchers is absolutely essential, and in a first-class offensive in position warfare three hundred is the least number that should be provided for each division. These should be distributed as follows:—

Forty at each regimental aid post of the first infantry brigade and at each bearer collecting post, and sixty at the advanced dressing station.

A definite date by which O.C.s field ambulances are to complete the work allotted to them must be given. It should be remembered that any dumps of stretchers formed before "Z" day must be carefully screened from the observation of hostile aircraft.

The position of the A.D.M.S. will, of course, be given in R.A.M.C. orders. He should, in position warfare during a big offensive, be at the advanced divisional headquarters, or, perhaps better still, form his own headquarters at or near the advanced dressing station. At either place he will be in a position to get first-hand information as to the progress of the action and can easily visit the infantry brigade headquarters.

He should not be at the rear headquarters of the division with the other assistant directors of administrative services; no information of value is ever sent there during a battle when the divisional commander with his staff has formed an advanced or battle headquarters.

The A.D.M.S. must, during the battle, keep in the closest touch with the "G" branch. During the late war on the Western Front this necessity was two or three times emphasized in General Routine Orders.

The D.A.D.M.S. should remain at rear headquarters and supervise the rendition of the necessary returns.

We must now suppose that zero hour has arrived and that the first infantry brigade has gone over the top following closely the creeping barrage, and has captured the first objective.

The two companies of "A" field ambulance should first clear the line of any wounded resulting from the enemy's counter barrage fire and then "no man's land," and finally get into touch with the regimental aid posts of the battalions of the first infantry brigade established in the trenches of the captured first objective.

When this has been carried out, wounded brought to the regimental aid posts can be carried back to the advanced dressing station via the bearer collecting posts. Many of the enemy which held the first objective will have been captured and these should be employed in carrying stretcher

cases to the advanced dressing station. For this purpose the dumps of stretchers formed at the regimental aid posts will come in most useful.

Let us now suppose that one hour after zero the second infantry brigade has advanced and captured the second objective and that one of its battalions has gone forward and taken up an advanced position as indicated on the diagram in a hachured line. When this second infantry brigade advances the two companies of "B" field ambulance should follow up the advance widely extended. Their strength must not be depleted in carrying casualties to the rear during the advance over "no man's land" and the first objective. Such casualties should be dressed and left to be cleared by the bearers of "A" field ambulance.

The advance of the companies of "B" field ambulance should be slow and the officers of the companies of "A" field ambulance should inform their officers where they are, in the first place, to bring the wounded consequent on the capture of the second objective. They should bring them to the regimental aid posts of the first infantry brigade established in the trenches of the captured first objective.

The companies of "B" field ambulance should halt, under cover if possible, after they have passed through the first infantry brigade until it is certain that the attack on the second objective is making good progress. Their officers should then lead forward their men and clear the ground of serious cases lying out between the first and second objectives, relieving the regimental stretcher bearers they may meet of their cases and sending them back to their companies.

After the second objective has been captured the officers of the two companies of "B" field ambulance should get into touch with the regimental aid posts of the second infantry brigade, and post squads of bearers at each to carry stretcher cases to the aid posts of the first infantry brigade from whence they will be carried by the bearers of "A" field ambulance to the bearer collecting posts and then to the advanced dressing station.

The senior officer of the two companies of "B" field ambulance must also select a site for a forward-advanced dressing station, which should be in some suitable place in the second objective, and staff it with the nursing and clerical duty personnel of the two companies. It will be remembered that he has been previously instructed to do this by the A.D.M.S., and for that reason the nursing and clerical duty personnel of the companies have remained with their units. When this forward advanced dressing station has been opened the A.D.M.S. should be informed at once.

After the first and second objectives have been captured, it may be assumed that the enemy's artillery fire will die down for an hour, or even two, until it is almost negligible; this is one of the features after a successful assault in position warfare. It is, perhaps, due to the hostile artillery, having lost communication with their forward observing officers after the first objective has been captured, being unwilling to fire until the situation has cleared up, and when the second objective has been lost to them many

of their forward guns will have been captured and the others occupied in a hurried withdrawal.

This period of comparative calm is a period of which the utmost use should be made to clear the wounded. Every use must also be made of the prisoners for this purpose.

As soon as the A.D.M.S. has been informed that a forward advanced dressing station has been opened, he should obtain the approval of the "G" branch to move forward the two companies of "C" field ambulance, and to employ them in the first place in carrying up spare stretchers from the forward dumps to the advanced dressing station recently established. When they have performed this duty, they should remain under cover in the second objective, and await the advance of the third infantry brigade on its way to the assault on the third objective.

Soon after the second objective has been carried all available labour will be certainly employed in repairing the road shown on the diagram as leading from our lines into the captured territory. In three or four hours it will probably have been repaired to the extent of being practicable for horsed ambulance wagons or light motor ambulance cars to get up to or near to the forward advanced dressing station.

The A.D.M.S. should ascertain when it may be possible to get cars or horsed ambulance transport on the road somewhere near the forward advanced dressing station and order one horsed ambulance wagon, from the four held in reserve, and one light ambulance car to make the attempt. Horses, men and transport must be freely risked in this attempt to get wheeled ambulance transport well forward. Even if they cannot get up to or near the forward advanced dressing station they should soon be able to get up to the captured first objective where a car or wagon post can be established and the wounded carried to the advanced dressing station by wheeled transport, and the long hand carry from the forward advanced dressing station to that first established cut out.

When this has been done the majority of the bearers of the two companies of "A" field ambulance can be assembled and opportunity given to them to eat a meal and to take rest. They will then constitute a valuable reserve.

The A.D.M.S. should take an early opportunity of visiting the forward advanced dressing station to observe personally the condition of affairs.

The third infantry brigade has yet to capture the third objective, and from the inspection of diagram No. 2 it will be observed that this brigade has a long way to go before it can get to a position from which it can deliver its attack, and its casualties will be heavy if the enemy makes a strong resistance. It is timed to leave its assembly trenches four hours after zero.

It will be remembered that two companies of "C" field ambulance have already gone forward and in the captured second objective are awaiting the arrival of the third infantry brigade.

After the battalions of the third infantry brigade have gone through the second objective, and have been joined by the battalion of the second infantry brigade which has been employed in covering the consolidation of the captured second objective, one company of "C" field ambulance should advance widely extended in rear of the advancing battalions and dress and form groups of all severely wounded; these groups will be removed to the forward advanced dressing station by the second company of "C" field ambulance which will advance in rear of it.

We will suppose that the third objective is captured about eight hours after zero. An hour or two before this the road should have been repaired to the extent of allowing light ambulance cars or horsed ambulance wagons to get up to or near the forward advanced dressing station, and the A.D.M.S. should have given orders for all such transport proceeding to this advanced dressing station to carry with it stretchers from the dump at the advanced dressing station.

It will also be possible for the A.D.M.S., if the hostile artillery fire in the first and second captured objectives has died down, and it will certainly have died down so far as the first objective is concerned, to issue orders for the bearers of the companies of "A" and "B" field ambulances to be withdrawn from the regimental aid posts of the first and second infantry brigades, whose R.A.M.C. officers should be instructed to clear any wounded from their aid posts to the forward advanced dressing station by means of their own regimental stretcher bearers. He will then have in hand what is left of the companies of "A" and "B" field ambulances, and should send forward the two companies of "A" field ambulance to get into touch with the companies of "C" field ambulance to form relay posts from the captured third objective back to the forward advanced dressing station. The two companies of "B" field ambulance should remain in reserve near the forward advanced dressing station.

It might be considered that now this dressing station is open and served by wheeled ambulance transport, the one first established might be closed down. This should not be done as the advanced dressing station formed in the captured second objective must, of necessity, be but a poor sort of place, and all that can be done there will be to dress cases as well as possible under the circumstances, and to send them to the advanced dressing station first established for further treatment, injection of antitetanic serum, etc. This certainly necessitates an extra unloading and reloading of the wounded from and into the ambulance cars, but it is unavoidable.

After the capture of the third objective the companies of "C" field ambulance should bring the wounded from the captured position to bearer collecting posts formed in places affording cover, such as gun-pits, etc., and as near roads as possible. From these places the bearers of "A" field ambulance should carry them back to the forward advanced dressing station.

In view of the approach of night the routes to be followed by "A" field ambulance bearers from the bearer collecting posts to the advanced dressing station should be marked out by means of sticks stuck into the ground at frequent intervals, each stick having a piece of white bandage tied on to it.

The A.D.M.S., as soon as he learns that the third objective has been captured, should have the roads leading forward to it reconnoitred with a view to establishing car posts as near as possible to the troops in occupation of the captured third objective. It will usually be found that these roads have not been much cut up by shell fire.

When the wounded of the third infantry brigade have been cleared, the two companies of "C" field ambulance must remain in touch with the regimental aid posts of the third infantry brigade. The companies of "A" field ambulance must remain in their positions to staff the bearer collecting posts and the relay posts established back to the forward advanced dressing station. The personnel of the forward advanced dressing station should during the course of the night be relieved by the headquarters of "C" field ambulance which has been held in reserve.

In position warfare, and indeed also in open warfare, an ample supply of spare stretchers is absolutely necessary at all stages of an action if the seriously wounded are to be removed quickly. Prisoners are no use to us unless we have stretchers available so that they can remove the wounded. Every opportunity must be taken to get spare stretchers forward from the dumps. One way of doing this is to cause every squad of bearers to carry forward two stretchers instead of one after they have brought a case back to a bearer collecting post.

The dispositions described above are not by any means entirely imaginary. They are, in so far as their main details are concerned, those employed by the Third Division at the battle of Arras in April, 1917, of which division the author had the honour of being A.D.M.S., and they worked extremely well in spite of very adverse weather conditions.

XI.—The Disposition of Field Ambulances when a Division is on the Defensive in Position Warfare.

For the purposes of this section let us imagine that we belong to an army which has, for some reason or other, lost the initiative and is obliged to remain on the defensive, and to hold a front of about four thousand yards for a period during which it is certain that an offensive on a large scale will be undertaken by the enemy against us, as soon as he can make adequate preparations.

The defensive system of our imaginary division we will suppose to consist of a forward or covering zone, and a main zone.

Both of these zones will be organized in depth, and we will imagine the forward zone to consist of a series of mutually supporting strong

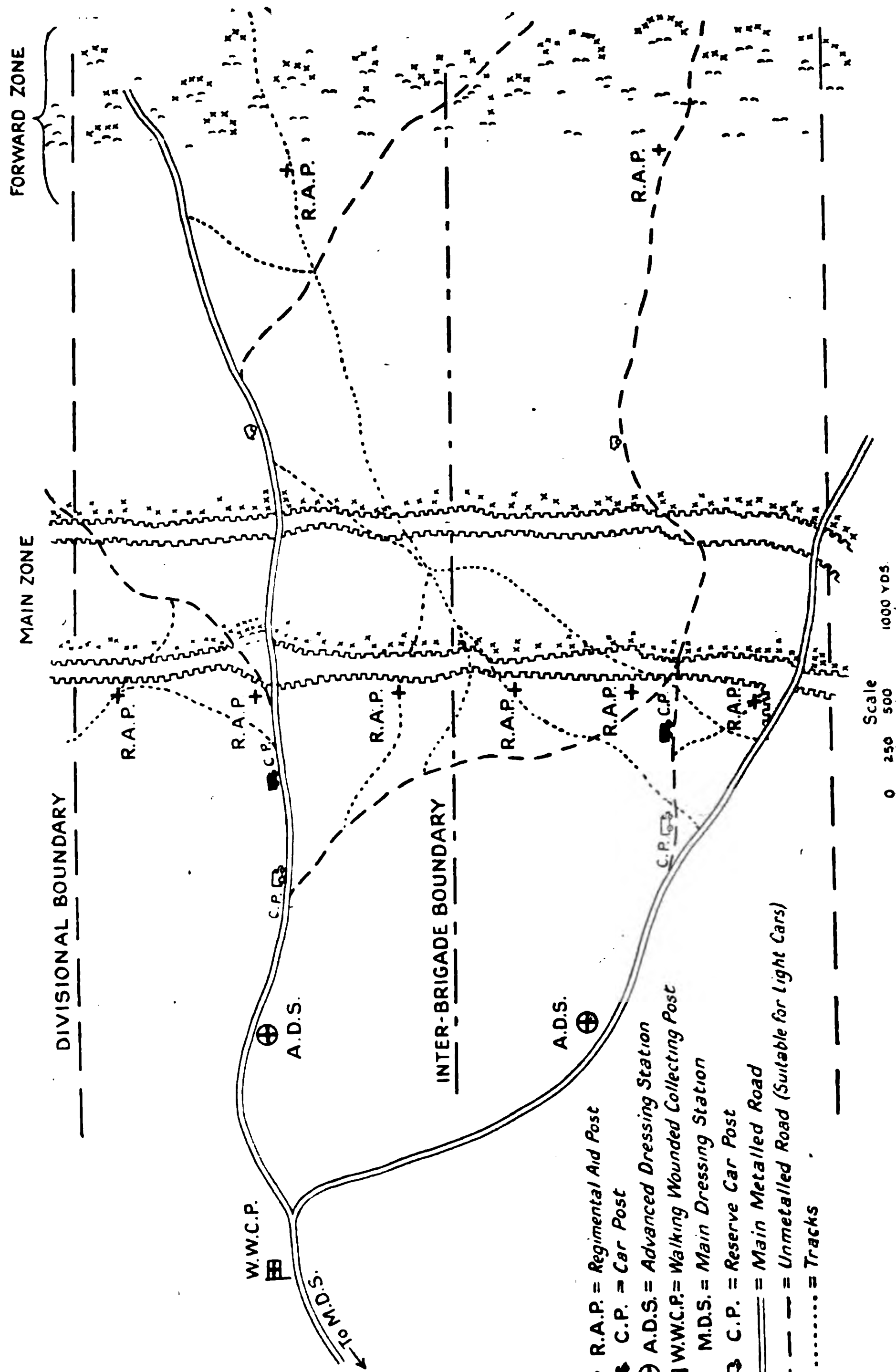

DIAGRAM No. 8.—To illustrate Section XI.

points; to have an average depth of about six hundred yards, and to be distant about two thousand yards from the main zone.

The main zone we will suppose to consist of front and support line trenches, with a reserve line about seven hundred yards in rear of it.

There would also be other defensive systems in rear of the forward and main zones for occupation in the event of necessity, but these are not shown on the diagram No. 3 which is intended to illustrate this section.

We will now suppose that the divisional commander has decided to hold his defensive system with two of his infantry brigades in the line, each on a front of two thousand yards, and to keep his third in reserve. Each of the two brigades in the line is to be assumed to have one battalion in the forward zone, and the remaining three in the main zone.

Let us now consider in detail the arrangements the A.D.M.S. must make so that everything may be in readiness for the expected attack.

The siting of the regimental aid posts is a matter for the battalion commanders concerned. The headquarters of the two battalions in the forward zone will be somewhere immediately in rear of the localities occupied by the troops, and the regimental aid posts should be placed close to these headquarters.

The regimental aid posts of the six battalions in occupation of the main zone we will suppose to be in the reserve line of that zone.

The front held by the division is a fairly long one, and, in consequence, two advanced dressing stations will be required, one for the service of each brigade in the line.

These stations must not be so far forward as to become untenable in the event of the enemy capturing our forward zone, but should be at least two thousand yards in rear of our main zone, so as to be capable of functioning as dressing stations for the service of the troops defending that zone. They must be sited on roads, or tracks, practicable for motor ambulance cars in all weathers, or capable of being made so, and the roads should be those leading forward to the line.

The distance from the regimental aid posts to the advanced dressing stations will be about two thousand yards for those in the reserve line of the main zone, and as much as three thousand nine hundred yards from the regimental aid posts of the two battalions in the forward zone.

These distances are too great for the hand carriage of the wounded from the regimental aid posts to the advanced dressing stations. To obviate this difficulty light ambulance cars must be made use of, and two car posts must be formed on the roads leading forward from the main to the forward zone for the service of the battalions occupying the forward zone. These car posts should be sited in covered positions about one thousand yards in rear of the regimental aid posts, and should each be provided with a steel shelter well sandbagged for the protection of wounded awaiting evacuation to the advanced dressing stations.

In addition, two more car posts must be provided for the service of the regimental aid posts of the six battalions occupying the main zone, one car post for each three battalions. These car posts should be situated about five hundred yards in rear of the reserve line of our main zone.

In the event of our losing the forward or covering zone and the enemy attacking our main zone, the two car posts serving the regimental aid posts in the forward zone must, of course, be abandoned. The car posts in rear of the main zone will also become too far forward, and two other sites each about one thousand yards in rear of our main zone should be selected, and provided with steel shelters for use in the case of the necessity arising. The steel shelters of the car posts given up can then be made use of as bearer-collecting posts.

The A.D.M.S. must also reconnoitre the defensive systems in rear with a view to the R.A.M.C. arrangements necessary in the event of their being occupied owing to the loss of our forward and main zones, and should draw up a scheme as to how this is to be done, which, however, he should only divulge to his D.A.D.M.S. until the time comes when it must be made use of.

If position warfare has been in vogue for a long period, advanced dressing stations suitable for the purpose will probably be in existence, but in any case there will be much work for the personnel of the field ambulances to do, and it should be a point of honour not to ask for assistance, unless it is absolutely necessary, owing to the technical difficulties.

A site for the divisional main dressing station must next be chosen, and this station should be well beyond the range of the enemy's medium artillery. The position for a walking wounded collecting station still remains to be selected, and tents, if available, should be made use of for this station, but they must not be pitched until the expected attack has begun. The tent pegs should, however, be driven in, a field kitchen, latrines, etc., constructed and the tents stored on, or near, the position chosen, well screened from the observation of hostile air-craft. Tracks for the use of walking wounded by which they can make their way to the collecting station must also be decided upon.

The A.D.M.S. when he has completed his scheme must submit it to the "G" and "A" branches of the staff for approval. After it has been approved, the field ambulance commanders should be informed, and the scheme explained to them, and each unit made responsible for the carrying out of its share of the work necessary to make the advanced dressing stations proof against medium artillery, and for the construction of steel shelters for the car posts, the repair of roads, etc.

The O.sC. field ambulances must also be informed as to what dispositions are to be made so that there shall be no possibility of the attack finding them unprepared.

One field ambulance will be required for the duty of clearing the wounded from the aid posts in the forward and main zones, and also for the provision of the staff for the advanced dressing stations. To enable this to

be done efficiently, the two companies of another field ambulance, less their nursing and clerical duty personnel, which will be required to staff the walking wounded collecting station, should be attached to it for duty.

Another field ambulance will be required to staff the main dressing station with its headquarters, supplemented by the nursing and clerical duty personnel of its two companies; the remainder of the two companies of this field ambulance should be attached to the reserve brigade for duty, while the headquarters of that unit which has given its companies to the one responsible for clearing the aid posts should be held in reserve.

The A.D.M.S. will, of course, not be able to foretell when the expected attack will begin, but in order that he may not be taken by surprise, he should issue orders that his field ambulances must each day after dark be in the positions outlined above, ready to carry out the duties required of them in case of the necessity arising.

The necessary constructional work to be carried out by the R.A.M.C. personnel in the daytime must not be interfered with, but, as in position warfare big attacks are almost always made at dawn owing to the difficulty of assembling the attacking troops by daylight, all the R.A.M.C. personnel must be in position before daybreak.

Orders should also be given that, in the event of attack, all motor ambulance cars in the division, less those required at the car posts forward of the advanced dressing stations, are to be pooled to form a divisional motor ambulance convoy on the lines laid down in Section VIII, and places where a main rank of cars and the car posts are to be formed should be named in the orders. If the above recommendations are carried out, when the attack is launched all that has to be done is to pitch the tents for the walking wounded collecting station, and to send off the cars to the places agreed upon to form the divisional motor ambulance convoy. O.sC. field ambulances should not wait for orders from the A.D.M.S. to do this.

If they have any knowledge of warfare they will know by the intensity of the enemy's artillery fire that the expected attack has begun.

It is hoped that No. 3 diagram will be of use in explaining the arrangements described in this section.

XII.—The R.A.M.C. Arrangements for a Rear-guard covering the Retreat of a Division during a Deliberate Retirement.

The R.A.M.C. arrangements for a rearguard covering the deliberate retirement of a division are difficult to arrange, and, no matter how well they may work in practice, it is inevitable that some of the severely wounded of the mobile troops of a rearguard will be left behind and fall into the hands of the enemy.

Field Service Regulations, vol ii, lays down very clearly what a rearguard should do, when covering a retreating force. The cardinal principles are, perhaps, the following:—

(1) The rearguard is to hold a defensive position, and by the fire of its artillery and machine-guns to force the enemy to deploy at as great a distance as possible from the defensive position.

(2) When the enemy has begun to deploy, the infantry of the rearguard is to begin to withdraw to another defensive position, leaving the artillery, machine-guns, and mobile troops to cover its retirement, and by their fire to delay the advance of the enemy.

(3) The artillery and machine-guns are to begin to retire when the enemy attack is pressed more closely; the mobile troops are to make good their retirement last of all.

(4) The defensive position next occupied by the rearguard should be at such a distance from the one abandoned to the enemy as to make it necessary for him to reform column of route before arriving at a position from which he can make an attack on it with his infantry.

The duty then of a rearguard covering the retirement of a division is to hold a series of defensive positions for the purpose of delaying the advance of the enemy, and to inflict the maximum of loss upon him while it suffers the minimum itself.

Let us now imagine that we belong to a division about to carry out a deliberate retirement, covered by a rearguard composed of one infantry brigade, a proportion of mobile troops, artillery and engineers. What arrangements should the A.D.M.S. make for the collection and care of the wounded?

If he is to make successful dispositions of his three field ambulances, which we will designate as "A," "B," and "C" field ambulances, he must be in the confidence of the Staff.

In the first place, in consultation with the "A" branch, a site for a main dressing station should be fixed, and this station should be sited in suitable buildings at some place on a main road, about two or three miles in rear of the area in which it is proposed the division shall halt for the night.

It should be agreed that a walking wounded collecting station will not be established.

The first and second defensive positions to be occupied by the rearguard may be assumed to be known to the divisional staff and to the A.D.M.S.

A site for an advanced dressing station on a main road of evacuation about two or three miles in rear of the first defensive position should be chosen by the A.D.M.S., and another site, similarly placed, selected in rear of the second position.

"A" field ambulance, less its two heavy motor ambulance cars and its four horsed ambulance wagons, should be ordered to prepare the main dressing station before the division begins its retirement. The sanitary section, and all transport belonging to "B" and "C" field ambulances not absolutely necessary for use in action, should accompany this field ambulance, and march under the orders of its commanding officer.

"B" field ambulance, less its two heavy ambulance cars and two of its light cars, should accompany the main body with its two companies and four horsed ambulance wagons marching behind it. This arrangement will enable any troops sent from the main body to reinforce the rearguard to be accompanied by a proportion of R.A.M.C. personnel and ambulance transport. The remaining four light cars of this unit should march in front of the main body, halting from time to time to enable it to keep in touch with them.

"C" field ambulance should be detailed for the duty of collecting and evacuating the wounded of the rearguard, and, to enable it to carry out this difficult task efficiently and rapidly, the heavy cars of "A" and "B" field ambulances, two of the light cars of "B" together with the four horsed ambulance wagons of "A" field ambulance, should be attached to it for duty.

O.C. "C" field ambulance with his headquarters should open an advanced dressing station at the site selected by the A.D.M.S., making use of a minimum of equipment. At this advanced dressing station the six heavy cars of "A," "B," and "C" field ambulances, and the four horsed ambulance wagons of "A" field ambulance, should be stationed for the purpose of clearing the wounded into the main dressing station. The roads to be made use of for this purpose should be allotted by the divisional staff.

The responsibility for the collection of the wounded of the troops holding the defensive position is, also, laid on the O.C. of "C" field ambulance who has available for this duty his two companies, six light cars and four horsed ambulance wagons, together with two light cars attached to him from "B" field ambulance.

He should make the following arrangements (see No. 4 diagram):—

No advanced dressing stations should be opened by his two companies but each should form a bearer collecting post to which wounded are to be brought by the company bearers from the regimental aid posts.

These two bearer collecting posts must be as advanced as possible and be on a road or track practicable for light ambulance cars, and three of these vehicles with two horsed ambulance wagons should be allotted to each bearer collecting post. The remaining two light cars should be attached to the artillery and mobile troops.

The casualties from the troops of the rearguard must be brought rapidly to the bearer collecting posts and from thence transferred at once by means of the light ambulance cars and ambulance wagons to the advanced dressing station, where they will be unloaded, and, after necessary attention to them, sent by means of the six heavy ambulance cars to the main dressing station. The light cars and horsed ambulance wagons working with the companies after they have been unloaded, are to return at once to the bearer collecting posts to clear more wounded. It is, perhaps, unnecessary to state that the heavy ambulance cars as soon as they have

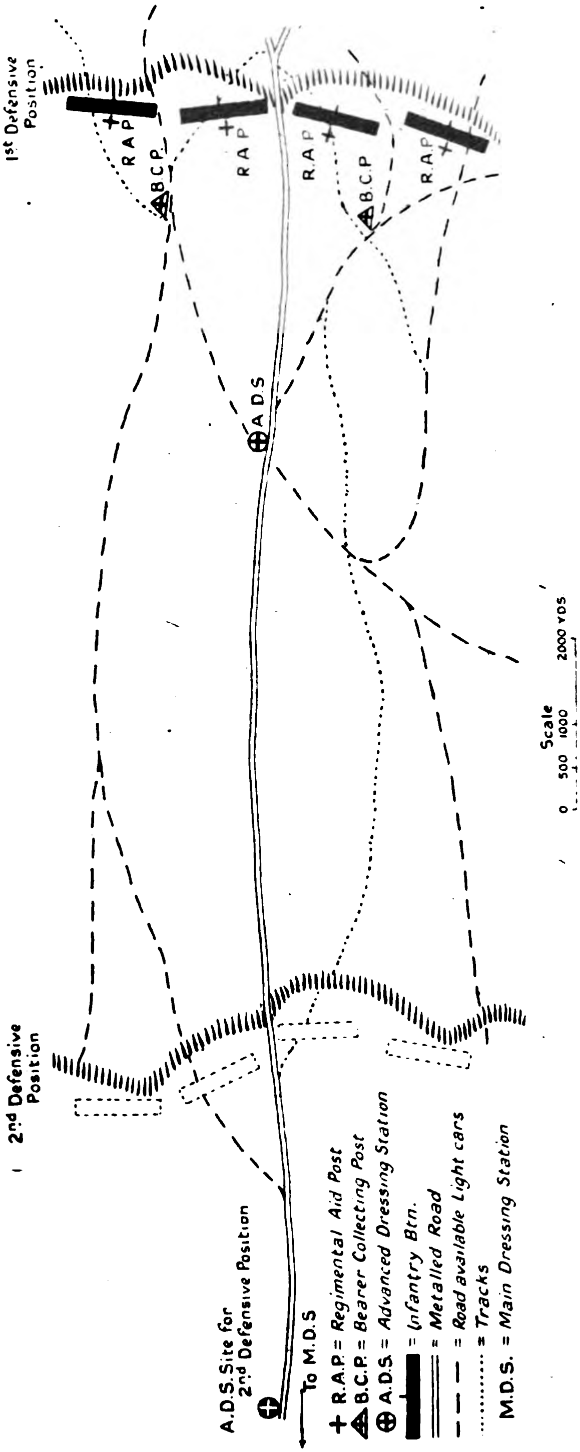

DIAGRAM No. 4.—To illustrate Section XII.

arrived at the main dressing station, and have been unloaded, are to return with all speed to the advanced dressing station.

The four horsed ambulance wagons at the advanced dressing station should not be used at first in carrying wounded to the main dressing station. They should be kept in reserve to clear any wounded, who may still be at the advanced dressing station, when the time comes for it to close, retire, and reopen on the second selected site in rear of the second defensive position.

The light ambulance cars working with the companies of "C" field ambulance should, for the most part, be reserved for lying-down cases. Slightly wounded should be directed to the advanced dressing station, and wounded able to sit up, but not to march, should be carried to this station by means of the horsed ambulance wagons.

The companies of "C" field ambulance must retire with the infantry, when that arm begins to withdraw, and the light cars returning from the advanced dressing station, if not immediately required to remove wounded, should be directed to concentrate at some suitable place in rear, and there await orders.

When the withdrawal of the infantry of the rearguard begins, the advanced dressing station must close and retire to the site chosen as suitable for an advanced dressing station for the defence of the second position.

Any of the horsed ambulance wagons not made use of to evacuate wounded to the main dressing station should be ordered to join the R.A.M.C. companies of "C" field ambulance retiring with the infantry of the rearguard.

Slightly wounded cases collected at the advanced dressing station must not be directed to make their own way to the main dressing station. If they are allowed to do so, they will have the appearance of men who have retired from the rearguard without orders. They should be formed up under officers or N.C.O.s and marched in parties of not more than ten.

The A.D.M.S. must be informed of the approximate numbers of such slightly wounded men, and he should arrange with the "Q" branch for them to be met by any available transport, and carried to the main dressing station.

The arrangements for the collection of wounded from the second, or other defensive positions which the rearguard may hold, should be similar to those outlined above for the first.

The success of the scheme given here depends very largely on whether a good road, moderately clear of troops and transport, can be given by the staff for the evacuation of wounded from the advanced to the main dressing station. It is of vital importance that the heavy motor ambulance cars should have open roads to enable them to run quickly backwards and forwards between these two dressing stations.

This, however, is a matter for the staff to arrange, and is out of the control of the medical services.

AMŒBIASIS IN SECUNDERABAD.

By Captain S. SMITH.
Royal Army Medical Corps.

(*Continued from p.* 330.)

Chronic and Relapse Cases.

In these cases we have in the past put too much reliance on successive courses of emetine. One must now recognize a class of individual who may be called *emetine resistant,* for whom repeated courses of the drug are therapeutically useless and may even be dangerous. General tonic and dietetic treatment, and if necessary the administration of some astringent drug, such as tannalbin, residence away from endemic areas and even change home to England would appear to be the most rational line of treatment for such individuals.

It is doubtful if many of the so-called relapse cases are in reality true relapses. Many of them could more accurately be termed reinfections of susceptible individuals. This is of course difficult to prove, but the fact that many so-called relapses occur when the incidence of fresh cases is also high is suggestive.

Toxic Effect of Emetine.

I have seen no ill-effects from the use of emetine in patients treated in hospital; a few cases were noted to have an abnormally slow pulse-rate (averaging 38-42) while under treatment, but I do not consider this bradycardia to have been due to the emetine. There has been no case of a patient being readmitted to hospital after discharge on account of any ill-effects from the drug.

One case, an officer of the Royal Army Medical Corps, treated in quarters with a full course of emetine injections followed by a course of E.B.I. pills and a second half-course of emetine injections, suffered from marked debility, loss of weight, tremulousness and weakness of the hands and arms almost amounting to paresis, and a fine branny desquamation of the palms and wrists following the cessation of treatment. These symptoms were probably due, in part, at any rate, to the toxic action of the drug.

Complications and Sequelæ.

The relationship of *hepatitis* and *abscess of the liver* to amœbiasis has, of course, been definitely established, and it may be safely said, with certain reservations, that in India every case of inflammation of the liver met with is amœbic in origin. At the same time it must be realized that other factors play an important part.

Manson Bahr [9] has noted that the Indian sepoy, whilst equally—

probably more—susceptible to amœbic dysentery than the British soldier, suffers to a much less degree from hepatic inflammations.

The attached Chart III, which shows the relative incidence of dysentery, hepatitis, and abscess of the liver in European and Indian troops respectively emphasizes this point.

	Colitis B	Colitis I	Dysentery B	Dysentery I	Diarrhoea B	Diarrhoea I	Abscess of Liver. B	Abscess of Liver. I	Inflammation of Liver. B	Inflammation of Liver. I
1910-1914 (av.)	4·9		6·5	18·4	21·9	11·7	7	·1	7·6	1·0
1915	12·5		5·6	22·6	26·5	18·2	·5	·1	8·5	1·2
1916	13·8		8·2	26	26·5	13·7	7	·0	6·3	1·1
1917	13·3		11·1	13·8	25·7	13·7	6	1	4·9	1·0
1918	11·0		13·8	12·7	24·4	22·6	·7	1	4·1	·9
1919	10·2		14·2	10·5	31·1	20·6	·9	·1	4·0	·6
1915-1919 (av.)	12·1		11·1	15·4	26·5	18·8	·7	·1	5·3	1·0
1920	6·3		10·1	6·1	32·5	14·9	5	·1	3·0	1·0

Chart III.

Alcoholic excess is supposed to be a marked predisposing factor in the causation of hepatitis. The sepoy, although not as blameless as in the past in this respect, is even now much less addicted to strong drink than is the European. This fact, combined with the comparative simplicity of

	Northern Army 1917	1918	1919	1920	Average Both Armies (1917)	Southern Army 1917	1918	1919	1920
Dysentery.	6·1	5·2	7·4	6·7	11·1	16·4	21·1	19·7	14·6
Diarrhoea.	28·7	28·8	31·3	34·5	25·7	23·1	20·7	31·1	30·6
Hepatic Abscess:	·7	1·0	·8	·5	·6	·6	·6	·9	·6
Hepatic Congestion.	7·4	5·7	5·9	3·1	4·9	2·6	3·0	2·6	2·8
Enteric Group.	3·1	8·0	4·7	4·9	3·4	3·9	7·6	4·5	4·3

Chart IV.

the diet of the native, aided by some relative racial immunity, probably explains the comparative rarity of the liver complications of amœbiasis in his case.

Chart IV, compiled for the years 1917-1920, shows that while, as far as the British Army is concerned, dysentery is almost three times more common in the southern than the northern army, yet the

liver complications predominate slightly in the northern army, thus suggesting the influence of cold as a predisposing factor.

As regards seasonal influences the monthly distribution appears fairly even, and follows more or less closely that for dysentery.

Hepatitis is, I am convinced, as far as the European soldier is concerned, almost invariably amœbic in origin, and forms the presuppurative stage of amœbic abscess of the liver. By the general recognition of this fact, which has been brought home to us so clearly by the writings of Sir Leonard Rogers [10], many cases of incipient abscess of the liver may be aborted. It is of the very greatest importance that in all cases of hepatic tenderness, if combined with fever and a dirty tongue, especially when occurring in a locality where amœbiasis is endemic, specific treatment with pulv. ipecac., or its derivative emetine, should be immediately given.

Rest in bed, with the exhibition of salts and the old-fashioned remedy ammonium chloride, may cure many cases, but there will be many others for whom this treatment fails, and who will pass steadily on to abscess formation with all its attendant dangers, unless specific treatment with one or other of the ipecac. derivatives is employed.

After a fairly extensive experience with emetine I have never yet met with any harm in its use if the patient is *kept under supervision in hospital,* and its action in these early cases of hepatitis with slight liver tenderness and enlargement is so marked and immediate as to constitute the best diagnostic method at our disposal.

The average age incidence of forty-six cases of hepatitis was found to be 27·8 years (average age for all admissions excluding hepatitis was 22·6 years). The average age for seven cases of abscess of the liver was 34·7 years.

In this station we have met with two main types of hepatitis, which may be called: (1) *Generalized;* (2) *acute localized.*

(1) *Generalized Hepatitis.*—The onset may be acute, more often subacute, or even chronic, amounting to little more than a mere congestion of the liver. There is generalized uneasiness over the liver area, accompanied by slight tenderness, along the right costal margin often extending to the left of the mid-line. The patient complains of a sense of fullness over the epigastrium, and there is slight abdominal distension. There is usually a slight evening rise of temperature to 100° or 101° F., with only a slight morning remission; in the later stages the evening temperature becomes higher, average 102° to 103° F., with a well-marked morning remission or even intermission. The tongue is slightly furred and the bowels are constipated. The lower border of the liver is usually displaced two to three fingers' breadth below the costal margin, while the upper margin rises up to the fifth rib or the fourth interspace. There is usually increased dullness in the right axilla, and the air entry at the base of the right lung may be deficient. There may be a slight icteroid tint of the conjunctiva, but never in our experience true jaundice. Pain of a "gnawing" variety

is often felt in the right shoulder uninfluenced by movements of the arm. In slight cases the only symptom referable to the liver may be a slight "dragging" pain in the hepatic region when turning over in bed; when present this symptom is very characteristic.

This constitutes the early stage of hepatitis; the symptoms may subside under appropriate treatment, or it may pass on to the more serious condition of acute localized hepatitis.

(2) *Acute Localized Hepatitis.*—In this condition all the signs and symptoms of the early generalized hepatitis persist. In addition there is an acutely tender spot that can usually be covered by one finger, and which is commonly situated on the anterior aspect of the liver an inch or so above the rib margin, but it may occur anywhere over the hepatic area. The slightest "brush" with a finger over this very localized area may give the patient the acutest pain.

In addition to this symptom he is now obviously ill, his tongue is dry with a white or brown crust, the temperature is swinging and approaching the hectic type, although a continuous fever of a pneumonic or typhoid type is not uncommonly met with. The bowels are often constipated, and the patient may suffer from rigors and profuse sweats. There may or may not be a history of previous dysentery, although a history of diarrhœa with the occasional passage of mucus is commonly given. The blood-count is usually normal or there may be a slight leucocytosis.

This constitutes the immediate presuppurative stage of liver abscess, and if treatment with emetine be not commenced at once an abscess will result.

The following cases are examples of hepatitis:—

Case 3 (*Subacute Generalized Hepatitis*).—Lieutenant W., aged 27, was admitted to B.S.H., Secunderabad, on July 26, 1923, suffering from pain along the right costal margin and in the corresponding shoulder. He had had several attacks of malaria during the past two years, and had undergone a complete course of twelve grains of emetine by injection for a severe attack of amœbic dysentery in August, 1922. His temperature on admission was 99° F. and his pulse-rate 88, he was pale and sweating, and he looked ill. The liver was enlarged downwards to one finger's breadth below the right costal margin and upwards to the fifth rib. There was generalized tenderness along the lower rib margin, and he complained of a dull aching pain in the right shoulder. A W.B. count gave 6,500 leucocytes per cubic millimetre. There was a slight relative lymphocytosis but no eosinophilia. For the next few days his condition remained unchanged, his temperature was of a regular intermittent type, rising to 100° F. every evening, blood smears were negative to malaria, and sodium salicylate failed to allay the pain in his right shoulder, which was always worse at night, sometimes keeping him awake. It was noticed that the shoulder pain was not affected by movements of the arm. The air entry and percussion note were defective at the base of the right lung. Emetine

injections were commenced on August 1, and that night his temperature dropped to normal for the first time. The hepatic tenderness and shoulder pain also left him that day, and he slept well for the first time since admission. On the evenings of August 3 and 5 there were evening rises of temperature to 102° and 103° F., in spite of which he slept well and complained of no further pain. A blood smear taken on August 5 contained numerous benign tertian rings. The emetine injections were continued to a total of eight grains and quinine was given. There was no further rise of temperature, and he left hospital cured ten days later. Six months after discharge he was as well as he had ever been and was putting on weight.

This was a moderately severe case of generalized hepatitis which reacted rapidly to emetine medication.

The onset of malaria in a malarial subject following emetine injections has been noted in several cases. It is apt to mask the beneficial action produced by the emetine.

Case 4.—Corporal H., aged 28, was admitted to hospital on February 24, 1923, complaining of acute localized pain in the right side of his chest. He had been in hospital four months previously suffering from an acute attack of amœbic dysentery which had relapsed while under treatment with emetine. He admitted to being a moderate beer drinker (averaging four pints daily, more on occasion). He dated the onset of pain in the right side two days previously on return from a tour of duty at Deolali. On admission patient looked ill and his colour was bad. There was an *acutely* tender spot two and a half inches to the right of mid-line at the level of the costal margin. The pain did not shift in position, and was stabbing in character. The lower border of the liver could be felt one inch below the right costal margin. Temperature on admission 103° F., blood smears were negative to malaria, and a stool was negative to *E. histolytica*. In view of the definite history of a previous and resistant attack of amœbic dysentery and of his present condition, there was no doubt as to the diagnosis, and emetine injections were commenced at once. The only symptom that remained after the first day's treatment with emetine was slight pain of a dragging nature over the liver area when patient turned in bed, a common complaint of mild and recovering cases of hepatitis. His temperature fell to normal for four days, at the end of which time he noticed a return of pain in his right hypochondrium and his temperature rose to 101° F. The emetine injections were continued every morning, and pulv. ipecac. was given every night in twenty-grain doses in the form of a bolus preceded by fifteen minims of tinct. opii. Under this combined treatment his symptoms quickly subsided; he was discharged fourteen days later to duty, and after eight months had not reported sick.

Case 5.—Private E., aged 31, was admitted to B.S.H., Secunderabad, on March 11, 1922, complaining of pain under the ribs just to the left of the mid-line. He had first noticed the pain two days previously; had been

unable to eat, but was able to carry on with his duties. There was no definite history of dysentery, but he had suffered from mild diarrhœa with occasional passage of slime some weeks previously. He was a moderate beer drinker. On admission his colour was bad (greyish), his temperature was 100·3° F., pulse-rate 112, and he complained of acute pain and tenderness over a small area immediately below the costal margin two inches to the left of the mid-line; the pain caused him difficulty in breathing (respirations 26). The slightest "brush" with the finger over this area made him wince. Emetine injections in one-grain doses daily were at once commenced. By March 15, 1922, the pain had eased considerably, and was now only noted if the area was palpated or on turning in bed. There was still a slight evening rise of temperature to 100° F. After thirteen grains of emetine had been given there still remained slight pain over the localized tender patch, and the evening pyrexia persisted. The patient was given enemata, consisting of three grains of emetine dissolved in four ounces of water, in the hope that direct absorption might take place into the portal system. There was no improvement after three days of this treatment and so he was given pulv. ipecac. in daily doses of fifteen grains for six doses. His symptoms now rapidly cleared up, he was discharged to duty after a fortnight, and seventeen months later had not reported sick.

It is interesting to note that emetine, although having a remarkable and immediate effect both on the hepatic enlargement and pain, and on the temperature in these cases of acute localized hepatitis, seldom produces a complete cure unless followed by the oral administration of pulv. ipecac. which even in small doses is apparently able to finish the task so admirably initiated by the emetine.

Both Cases 4 and 5 were moderately severe examples of acute ocalized hepatitis probably bordering on abscess formation.

The history of "beer" in both is characteristic of the group.

Abscess of the Liver.

This serious condition is only one step more advanced than the previously described *acute localized hepatitis* and must in my opinion be invariably preceded for a longer or shorter period by some form of non-suppurative hepatitis.

To use an "Irishism," the ideal treatment of liver abscess should be its prevention or treatment in the presuppurative stage. If every case of hepatitis were recognized and treated the fully developed liver abscess would become a disease of only historical interest, or limited to that small class of debilitated individuals who could not be made to react to emetine treatment in the early stages of the disease.

My experience of abscess of the liver is limited to two cases; both were treated by repeated aspiration and the injection of emetine solution into the abscess cavity. Both recovered. This experience, although very small, leaves me with a very decided preference for aspirations, repeated if

necessary, followed by the injection of a solution of emetine into the abscess cavity in place of the time-honoured open drainage operation. Secondary infection of the abscess cavity by pyogenic organisms must be common following the open operation, however much care is taken by the surgeon over subsequent dressings.

One has only to read Sir Leonard Roger's writings, and more especially his recent Lettsomian lectures, to realize the great reduction in the mortality-rate following operation for liver abscess in the Army since the general adoption of the principles of treatment so strenuously advocated by him.

Other Complications and Sequelæ.

As mentioned above true *appendicitis* is not an uncommon complication of amœbiasis. E. P. Hagan [11] describes the microscopic and clinical characters of a case of ulceration of the appendix and Captain D. C. Scott, O.B.E., R.A.M.C., has published notes on a case from this hospital in a recent number of the *Guy's Hospital Gazette.*

Amœbic abscess of the *brain* and *lung* are frequently mentioned in the literature, but we have not met with examples of either of these two complications in our small series of cases. Perforation of the cæcum or elsewhere along the large intestine is also described.

Joint Complications of Amœbiasis.

Captain Scott had under his care in this hospital last year a very interesting case of arthritis of the left knee-joint in which active entamœbæ were found in the pus taken from the disorganized joint. Brief notes of this case are worthy of record :—

Case 6.—Serjeant C. was admitted to B.S.H., Secunderabad, on March 17, 1922, complaining of pain and swelling in the left knee. He gave a history of having had severe diarrhœa with the passage of slime three years previously while on the frontier. On March 26, 1922, the knee was aspirated and about fifteen cubic centimetres of greenish viscid fluid containing a few pus cells were removed. Further aspirations were performed on April 3 and 13, 1922, without affording him any relief. The aspirated fluid was sterile in each case. From the time of admission the patient went steadily down-hill, he ran a continuous evening temperature averaging 100° to 102° F., lost weight, and was unable to sleep at night. At last his general and local condition became so bad that amputation above the knee-joint was advised and performed. The joint on being opened up subsequent to amputation was found to be profoundly disorganized with sinuses running down to the tibia and fibula. A sample of pus taken from the joint cavity contained *E. histolytica* exhibiting active amœboid movements. The patient was immediately given emetine injections and made an uninterrupted recovery.

I have had under my care during the past three years at least two cases who, while undergoing treatment for amœbic dysentery, developed acutely

painful and swollen joints from which a few cubic centimetres of sterile greenish fluid were removed. The patients thus affected were undergoing emetine injections and the joint condition, the ankles and knees being chiefly affected, resolved in from seven to fourteen days. Most authorities look askance at these joint complications of amœbiasis, considering them to be either complications of a co-existing bacillary dysentery or wrongly diagnosed, the giant cells commonly present in acutely inflamed joints being mistaken for *E. histolytica*.

In the case of Serjeant C., however, the amœbæ were actually shown to be in an active vegetative stage, exhibiting free amœboid movements on the warm stage; it appears extremely unlikely that these could have been confused with any form of tissue cell. References to the joint complications of amœbiasis do occur in the literature from time to time, and one author has gone so far as to describe a type of chronic osteo-arthritis due to the amœbæ of dysentery.

Urinary Amœbiasis.

J. W. S. Macfie [12] records cases of this very rare complication in which amœbæ were actually found in the urine.

I had one case under my care suffering from what appeared to be acute pyelitis or pyelo-nephritis, whose condition rapidly cleared up under emetine medication, although we were never able to find amœbæ in his urine.

Case 7.—Serjeant G. was admitted to B.S.H., Secunderabad, suffering from acute pain and tenderness in the left loin immediately under the left twelfth rib. Pus and albumin were present in his urine. Frequent catheter specimens of his urine were taken but nothing could be grown on culture. A guinea-pig was inoculated with a sample of the urine with no ill-effect. Von Pirquet's reaction was negative. While under observation in hospital the patient's condition grew worse, he lost weight, his appetite failed, he ran an evening temperature averaging 101° to 103° F., the pain in his loin increased in severity and he was noted to have an area of impaired resonance and diminished breath sounds at the base of his left lung. There had now developed a small œdematous area covering about a hand's breadth with its centre over the left twelfth rib. A white blood count gave 12,000 leucocytes per cubic millimetre. He was only passing a pint of urine in the twenty-four hours although he was taking diuretics and large quantities of fluid. X-ray and cystoscopic examinations revealed no abnormality. After three weeks under observation in hospital, during which time he had gone steadily down hill, emetine injections were commenced. Immediately he started to improve and although he continued to pass a small quantity of pus in his urine he put on weight, his appetite rapidly came back, the swelling in his loin disappeared and his temperature gradually returned to the normal. He was discharged to duty a month later apparently cured.

One is tempted in a case such as this to treat as *propter hoc* what may be only *post hoc,* and as we have no positive evidence of amœbiasis in this case we may be giving to the emetine credit which is not in reality its due.

In conclusion it only remains to be said that the type of dysentery in this station with few exceptions has been mild and complications few.

During the past three years we have had no deaths among 200 adult cases of amœbiasis treated with emetine or pulv. ipecac.

Every effort has been made by the sanitary authorities to stamp out the disease, but so far our yearly returns show no decrease and probably will not do so until our knowledge concerning the spread of amœbic dysentery becomes more complete.

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THE POSITION OF RICKETTSIA AS AN ÆTIOLOGICAL FACTOR IN DISEASE.

By J. A. ARKWRIGHT.

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No notable progress has been made in the study of typhus fever during the last few years comparable with such discoveries as the part played by lice in the natural transmission of the disease, the transmissibility to guinea-pigs, the establishment of the association of the disease with rickettsia in lice or the agglutination of the *Bacillus proteus X* by the serum of patients. Nevertheless, much work has been done, and a number of important accessory facts have been learned while these four discoveries have been almost universally confirmed.

The natural desire to form a more complete picture of the infective cycle in man and the louse has led to what perhaps have been somewhat hasty interpretations of incomplete observations and the formation of rather unbalanced hypotheses. The only two other diseases besides typhus with which rickettsia is known to be concerned, namely, Rocky Mountain spotted fever and trench fever, have not been open to examination by so many workers. The former is confined geographically to a rather limited area and the latter, though possibly widespread, is as a rule unrecognized during times of peace, and the observations made on it during the war can therefore scarcely be repeated at the present day, and are in the main only open to re-examination by means of control observations on normal men or those suffering from other diseases and on healthy uninfected lice.

Rocky Mountain spotted fever has been further investigated, both as regards the transmission by the tick and the infection of wild animals. The ætiology of this disease and the relation of the virus to the invertebrate host do not run exactly parallel with these factors in typhus and trench fevers, since the tick has a very different anatomy and physiology to the louse, is not confined to one mammalian host and has a much longer and more complicated life history. The facts at present known and the appearances in the tick associated with infection, however, strongly support the view that *Dermocentroxenus rickettsi*, the minute form found in infected ticks, is of a similar nature to *Rickettsia prowazeki* and *R. quintana*.

The critical cytological study by Nicholson [1] of the staining properties of the rickettsia of Rocky Mountain fever as compared with other granular forms met with in the vertebrate and invertebrate hosts has a direct bearing on the present subject. This writer finds that rickettsia in tick and guinea-pig tissues is easily distinguished from mitochondria, which stain with aniline fuchsin and methyl green, and from other granules—remains of

nuclei and red blood corpuscles—which stain with iron-hæmatoxylin. The more recent views and speculations concerning rickettsia bodies and their nature which have appeared of late years have taken mainly three directions.

(1) The occurrence of rickettsia as intracellular parasites in the tissues of mammals suffering from Rocky Mountain fever has been described by Wolbach, and corroborated by Nicholson. As regards typhus in man and the guinea-pig similar claims have been made by Jaffé and Kuczinski, and with much greater detail and apparently with a higher proportion of successful attempts by Wolbach, Todd and Palfrey [2]. Other workers have often failed to confirm these observations, or at any rate to completely satisfy themselves as to the nature of bodies called *R. prowazeki* which have been found in mammalian tissues. The exhaustive and careful work of Wolbach and his colleagues, however, at present holds the field.

(2) Several claims to have cultured *R. prowazeki* in artificial media have been put forward by different workers, who believe that they have shown in this way that rickettsia is a microbe belonging to a special, though at present not very well defined group of organisms. For instance, Kuczinski stated that he had obtained cultures on a special medium. Barykin and Kritsch described cultures in mammalian tissues of their *Microbion typhi-exanthematici* which these writers considered possibly identical with rickettsia.

More recently Wolbach and Schlesinger [3] have reported the survival in cultures of mammalian tissues both of the virus of Rocky Mountain spotted fever and of typhus for twenty-eight days, accompanied by what they consider conclusive evidence of multiplication of the rickettsia inside tissue cells. They, however, obtained no evidence of an increase free in the plasma, nor of passage from one cell to another in the cultures.

In this connexion may be mentioned Nöller's detailed account of the culture of *R. melophagi* from the leucocytes of sheep's blood, which, however, needs confirmation.

(3) Another result of the attempts to simplify and comb out the tangled claims of divergent opinions has been the rather unexpected capitulation by several Continental writers to the view of Friedberger that *R. prowazeki* is merely the form which *B. proteus X* assumes in the louse. The attraction of this hypothesis is that when combined with the view that the *B. proteus X* is the cause of typhus fever, the curious association of typhus with agglutinins in the blood for *B. proteus X* and the occurrence of the same bacillus in the stools, urine or blood, at any rate of some patients, are explained and brought under a single unifying idea. The additional evidence advanced by Weil, that rabbits which have received a dose of typhus guinea-pig virus can be shown also to have agglutinins for the X bacillus in their blood, would also be rendered intelligible. Weil himself appears to have subscribed to this view, indeed he took a prominent part in developing it, though he usually made a reservation to the effect that

the relation of the typhus virus to the *B. proteus* X might be one of constant association rather than of identity.

A later form of the view that the typhus virus is thus bacillary in nature has been espoused by Weigl, who has done such remarkable work in studying the artificial feeding and infecting of lice *per anum*. This author now appears to regard *R. prowazeki*, *B. proteus* X and *B. typhi-exanthematici* of Plotz as essentially identical, but as adaptations to different environments. Rabinowitsch has recently written adopting this hypothesis as an extension of his claim in 1909 to have found the causative micro-organism in a diplococcus present in the blood of patients.

It seems hardly likely that these views will on the existing evidence find general acceptance by bacteriologists.

(4) The latest additions to the literature of the subject have been by Woodcock [4, 5], who adopts a view in accordance with his comprehensive scheme of "hæmetaboly" in relation to disease. He maintains that rickettsia bodies are not really independent living micro-organisms, but are merely a stage in the breaking down of previous formed elements, especially of mammalian red blood corpuscles and the nuclei of mammalian leucocytes, but also of the nuclei of the cells of the gut and other cells of the insect host.

This view, except in so far as the chromatin and hæmoglobin are held by him to play a predominant or almost exclusive part, is essentially that which has of necessity met at the outset every investigator who has sought for microscopic evidence of the presence of virus in the louse, whether in connexion with typhus or trench fever.

The questions which were posed to the present writer and his colleagues when investigating these two diseases, as they have no doubt confronted previous and contemporary workers such as Sergent, Rocha-Lima, Otto, Topfer, etc., as well as the critics Nicolle, Brumpt and others, have been the following: Are there any bodies in the excreta or contents of infected lice which can be distinguished from the numerous granules of cell debris, pigment and bacteria which occur in similar preparations from normal lice? If so, what is the range of their size and shape; how constantly can they be found, and at what stage of the disease, or at what period after the louse has fed on a patient? These questions required careful and detailed study of many lice at different periods after feeding, and only by prolonged observation could definite criteria be set up and the above questions satisfactorily answered.

The conclusions arrived at with considerable details of the research can be found in the papers already published on the subject.

Plates illustrating the appearances found in lice are at best unsatisfactory evidence, though useful to indicate the forms to be sought in actual specimens. The only convincing evidence to any one wishing to decide for himself the value of the conclusions and the criticisms directed to them, is the examination of stained films or sections. Fortunately, many of

those made by the late Mr. Bacot, my other colleagues and myself are still extant, especially those made from lice taken in series at different periods after an infecting feed on trench fever patients. These can be examined at the Lister Institute by any one interested in the subject. The criticism of Woodcock is really directed against two distinct elements in the rickettsia theory: (1) the exclusive association of certain forms of rickettsia with disease; and (2) the nature of rickettsia.

(1) He denies that rickettsia found in association with lice from cases of typhus and trench fevers are different in kind from bodies found in normal lice, and states that when examining films of admittedly normal lice he finds forms which he calls rickettsia. These forms may be much larger or smaller or of similar size to the typical rickettsia of lice from cases of disease. He says that he finds microscopic evidence that these are derived from broken-down mammalian red corpuscles and leucocytes, and also from spermatozoa and other cells of the louse. He also quotes with approval the forms from normal lice called rickettsia by di Mello, many of which are, judging from the description, indistinguishable from bacteria of ordinary size, as indeed are some of the forms figured by Woodcock himself.

The question is really whether amongst the debris and bacteria in smears of lice and louse excreta, other forms—true "rickettsia"—cannot be distinguished, which are really distinctive of disease-bearing lice as opposed to the objects seen in films from normal lice which are free from these particular bodies.

Those who, like the present writer, believe in the intimate association of rickettsia in lice with typhus and trench fevers in man have satisfied themselves that with due care and precaution this distinction can as a rule readily be made, whilst Dr. Woodcock professes himself unable to see any dividing line. In addition to this they believe that in most cases it is not very difficult by examining infected lice to distinguish between those containing the virus of typhus and those infected with trench fever, and that this can be done (1) most readily in some cases by the position of the rickettsia inside the gut cells in typhus and in the lumen of the gut in trench fever, and (2) by the different range of morphology of the rickettsia in the two diseases (Arkwright and Bacot [6]). Woodcock gives a certain support to this latter thesis, for he admits that in examining films of infected trench fever lice made a few days after the infecting feed, the appearance of immense numbers of uniform rickettsia is so striking that the picture is quite different from that found at an earlier date. He also does not deny that the location and shapes of *R. prowazeki* are different from those of *R. quintana*. He, however, believes that these peculiar features are due to the presence of different viruses in the two cases and their different action on the digestive apparatus of the louse and its pabulum. He suggests that the invisible mammalian virus in each disease has a different effect on the louse. It is true that the typhus virus causes the

cells of the gut of the louse to be shed and may cause the death of the louse, but this is generally regarded as the result of the multiplication of rickettsia inside the cells, whereas Woodcock believes that the digestive and metabolic processes of the louse are upset by an invisible specific virus, which by a process of hæmetaboly or chromatinoboly manufactures rickettsia which simulate micro-organisms. In any case the concurrence of a special kind of rickettsia with each of the two diseases is acknowledged. The association of each specific virus with a distinctive and recognizable form of rickettsia in the louse is the first and most important thesis which it is desired to maintain.

The intimate association of rickettsia with typhus virus has been further confirmed by showing that if the virus is transferred from man to the guinea-pig or monkey either by means of blood or the louse and then again lice are infected from the mammal, even after several passages in guinea-pigs, the characteristic rickettsia again appears in the louse gut (Atkin and Bacot [7]).

(2) The interpretation of the appearances met with in normal and infected lice and the nature of the rickettsia seen rests on a different basis to the claim for constant association with disease, since rickettsia cannot with any certainty be cultivated in artificial media. Whether rickettsia bodies really represent living organisms or special forms of digested cell *débris* is of necessity an inference based largely on analogy with other micro-organisms both as regards their morphology and apparent growth and multiplication in the louse gut, and on the nature of the infection of mammals.

A strong additional argument in favour of the rickettsia being a micro-organism is the demonstration by Ledingham [8] that rabbits inoculated with the excreta of lice infected with trench fever virus develop agglutinins for *R. quintana*, whereas the excreta of normal lice do not cause the production of any such antibodies. Observations on the agglutination of *R. prowazeki* from infected lice by the serum of typhus fever patients were recorded by Otto and Dietrich in 1917, and Ricketts also obtained results of the same kind with the similar bodies from infected ticks and the serum of patients suffering from Rocky Mountain fever.

That rickettsia is an independent micro-organism certainly seems the most probable and the simplest explanation, but the matter cannot be regarded at present as entirely beyond the region of controversy, and it rests on a different foundation to the surely established facts of the association of rickettsia with disease.

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Clinical and other Notes.

CASE OF RUPTURED TUBAL GESTATION.

By Major H. C. HILDRETH, D.S.O.
Royal Army Medical Corps.

I was called to see Mrs. H., aged 29, at 9 a.m., on February 22, 1924. She had suffered for three weeks from amenorrhœa ; periods had previously been regular, but four months ago she was two days overdue. She stated that she then suffered from acute pain in the right side. Normal period was twenty-eight days of four to five days' duration. Her bowels had been constipated for three days ; she took a dose of salts on the 21st and the bowels acted on the 22nd. The pain was slightly relieved by the action of the bowels. On commencing her household duties, she was seized with an acute pain in the right iliac region.

On examination, the pulse was 84, temperature normal, respirations 20, tongue clean but flabby; there was abdominal pain referred to McBurney's point, no rigidity or evidence of tumour could be detected, but tenderness was elicited on pressure over McBurney's point. Patient was kept under observation and fomentations were applied to the abdomen. She was visited every four hours during the day and up to the 10 o'clock visit her condition was satisfactory, temperature and pulse were normal and the pain had subsided.

At 10 p.m. her temperature was 99, pulse 90; there was recurrence of pain which she described of a pricking nature; tenderness was marked but no rigidity. Arrangements were being made for her transfer to Cork, when, as the result of getting her ready, hæmorrhage set in, followed by symptoms of shock, pallor, restlessness, coldness of extremities and a tendency to vomit though she never actually did so.

On vaginal examination the uterus was found antiflexed, cervix normal, there was no abnormal swelling or pulsation detected, but tenderness was marked in the region of the right ovary. The diagnosis of ectopic gestation was more than suspected, but as the woman's condition did not permit her removal to Cork, the symptoms of shock were combated and the patient was kept under observation for the night.

She passed an excellent night. In the morning her temperature was normal, pulse 80. The tenderness and pain had disappeared, but the abdomen presented a more distended appearance ; it was slightly tympanitic with slight rigidity ; there was no dullness in the flanks. If I had not had the opportunity of continuous observation, and been fortunate enough to see her immediately after the hæmorrhage, which was dark red in colour,

and intermittent, the preliminary suspicion of appendicitis might have been justified, especially as her condition was even better than when first seen. The case however was diagnosed ectopic gestation and sent to Cork. She was operated upon on the following morning (February 25, 1924).

HOUSE SURGEON'S REPORT.

The abdomen of Mrs. H. was opened and blood clot found in the peritoneal cavity. Right fallopian tube was found to be perforated and fœtus extruding. The tube was ligatured at the uterine and ovarian ends. She is progressing very satisfactorily.

A CONDITION OF ANAPHYLAXIS DUE TO DIETETIC ERROR.

BY MAJOR R. F. O'T. DICKINSON, O.B.E.

Royal Army Medical Corps.

No. 5944950 Gunner ——, aged 19, service, one year eleven months, reported sick on the morning of February 12, 1924, with a marked urticarial rash on the hips and thighs. He complained of a slight headache, but his general condition was good, no temperature, and no gastro-intestinal symptoms.

He had been on guard the night before, and while on sentry go he felt dizzy and had to be relieved. The rash consisted of large, raised red wheals of irregular and sinuous shape and was irritable. These wheals were of various sizes, but were mostly large, many of them being three inches long by one inch across. The rash was well marked on the hips and thighs, and the next day had extended to the feet and chest, and later to the forehead and scalp, in fact, the rash at this period covered more than half the superficial area of the body.

He was put to bed and given a smart saline purge, after which he was put on calcium chloride ten grains t.d.s., and small doses of adrenalin chloride solution (1 in 1,000). The rash disappeared on February 15, 1924, He was put on a soda and gentian mixture and ordinary diet. He was discharged to duty on February 18, 1924, none the worse for his attack.

The interest of this case appeared to lie in the fact that it was due to a hypersensitiveness to some foodstuff. On investigation it was found that the man was taking no drugs, nor had he had any vaccines or serums, and there were no symptoms of food-poisoning. The ration food was above suspicion.

After a little pressing I got the man to admit that he had eaten twenty bananas the day before he got ill. I think that most probably he had eaten a good many more. It is well known that certain articles of food, such as egg albumen, milk, fish, etc., originate supersensitiveness or anaphylaxis, and in view of the history given above it would appear that the bananas were the cause of the condition described.

SOME MODIFICATIONS OF STAINING PROCESSES EMPLOYED IN LABORATORY WORK.

By Quartermaster-Serjeant A. MALE,
Royal Army Medical Corps.
(From the Royal Army Medical College.)

Gram's method of staining sections is, as is well known, employed for the detection of the presence of organisms which retain the methyl violet component of the stain, a counterstain being subsequently applied to colour the tissue elements. Many of the counterstains employed do not clearly define histological detail or demonstrate organisms which fail to retain the methyl violet.

Many modifications of Gram's method which have been suggested to overcome this difficulty have certain limitations. Certain modifications may show histological detail and "Gram-positive" bacteria satisfactorily but are of little value if only negative bacteria should be present, whilst others may show negative bacteria and fail to demonstrate histological details.

For the above reasons attempts have been made to devise some form of counterstain which could be readily prepared and which, if applied after the preliminary steps of Gram's process had been carried out, would demonstrate both the nature of the tissue and the presence of either "Gram-positive" or "Gram-negative" organisms.

The following stain has been successfully tried with various kinds of sections.

Counterstain :—

Stock solutions	Neutral red ...	0·5 per cent in 50 per cent alcohol
	Light green ...	1·0 per cent aqueous solution

Method : Dilute the light green to 0·1 per cent and add an equal amount of the neutral red solution.

As microscopic dyes vary so much different samples were tried, including those of the British Drug Houses, Ltd., and Mr. G. T. Gurr.

When the above stains were mixed in the way described precipitation did not occur.

Method of Use :—

(1) Bring section to water.
(2) Methyl violet, 0·5 per cent aqueous, 1 to 2 minutes.
(3) Gram's iodine, 1 to 2 minutes.
(4) Decolorize with spirit.
(5) Wash in water.
(6) Counterstain, 3 to 5 minutes.
(7) Wash in water.
(8) Dehydrate with alcohol.
(9) Clear in xylol and mount.

Result :—

Gram-positive organisms	Blue.
Gram-negative organisms	Red.
Nuclei of cells	Red.
Cytoplasm	Various shades of green.
Connective tissue ...	
Muscle and blood cells ...	

A SUBSTITUTE FOR VAN GIESON'S PICROFUCHSIN.

As is well known, the employment of van Gieson's method of staining in conjunction with hæmatoxylin is open to the objection that the details of nuclear structure are frequently destroyed.

The following contrast stain, which fulfils the same purpose as van Gieson's stain, has been devised for use after staining with various hæmatoxylin solutions, and outlines both elastic and connective tissues in marked contrast to the epithelial elements, whilst the definition of nuclear structure is not obscured.

Stock Solutions :—

Martius yellow, saturated solution in 50 per cent alcohol.
Acid fuchsin, 1 per cent aqueous.

Martius yellow solution	4 parts	Mix
Fuchsin solution	6 parts	

The stain for ordinary use is better diluted 1 in 4 with distilled water.

The proportion of the two dyes may be slightly altered to meet individual requirements.

Grubler's martius yellow gave slightly better results than another which was tried.

The method of using the stain is as follows :—

Bring section to water.
Ehrlich hæmatoxylin, 10 minutes.
"Blue" in tap water, 10 minutes.
Counterstain, 3 to 5 minutes.
Wash in water.
Differentiate and dehydrate with alcohol.
Clear in xylol and mount.

Current Literature.—Pathology.

The Criteria of Cure in Tuberculosis of the Guinea-Pig, with Special Reference to Diaplyte Antigens. By E. H. Kettle, M.D.Lond., Pathologist, St. Mary's Hospital (from the *Lancet*, January 12, 1924).—Most individuals possess a good deal of natural resistance against the tubercle bacillus, and the treatment of tuberculosis by immunological methods has attracted much attention ever since the discovery of the bacillus. The treatment of tuberculous animals by various methods has frequently been used to obtain data prior to treating the human subject, but has in most cases proved an unsatisfactory basis of argument, as good results obtained in guinea-pigs have not been capable of repetition in the human being. The explanation of this is (1) that the animals vary very markedly in their reaction to the bacilli; (2) that fibrosis of the lesion, generally assumed to be an expression of cure, is by no means invariably so.

The most recent remedy suggested for the treatment of tuberculosis is the diaplyte antigen of Professor G. Dreyer. This is stated to give encouraging results in the treatment of tuberculous guinea-pigs and rabbits.

Surveying the evidence put forward by Dreyer in support of this, the author at once dismisses the rabbit experiments, as the details given are too meagre to allow an opinion to be formed. In the guinea-pig experiments the two main criteria on which conclusions were based were the duration of life after infection with tubercle bacillus and the curve of the body weight. He finds the evidence of improvement claimed by Dreyer for the diaplyte vaccine treated pigs to be inconclusive.

The author set out to conduct experiments along the same lines as Dreyer's experiments. He took a number of guinea-pigs divided into approximately equal batches, using one batch as controls, the other for experiment with regard to treatment. Animals of varying weight were purposely chosen to compensate as far as possible for the lack of absolute knowledge of the appropriate dose to be administered. Most of the animals were allowed to die naturally, but some were killed for various reasons. Every guinea-pig infected with living tubercle bacilli presented progressive tuberculosis post mortem.

The iliac, periportal, and tracheal glands were invariably affected as were often the left inguinal, the right axillary, and the cervical glands.

Three experiments were conducted.

Experiment 1.—Ten guinea-pigs were inoculated in the right flank with the tubercle bacillus. Of these, five were treated with weekly injections of antigen into the left flank and five were controls. All lost weight except two. One of these—a treated case—gained seven per cent of its body

weight; the second, an untreated case, gained fifty per cent. Of special interest are two treated cases which towards the end rapidly lost weight. Post mortem, the lymph nodes were found to be very small and hard, the spleen shrivelled and scarred, the liver firm and apparently cirrhotic. Despite these fibrotic changes bacilli were easily found in the tissues in question and active cellular foci were present in the spleen. In two untreated cases the lymphatic glands were enlarged but intensely fibrous, contained scanty tubercle bacilli, and the histology was that of an inflammatory lesion in the healing or fibrotic stage. In the liver it appeared fairly certain that natural healing was occurring.

Doubt was cast on the potency of the sample of diaplyte antigen used in this experiment. It is argued that if the antigen was potent the most that can be said for it is that it produced local reaction in the fibrosis of the glands, for active lesions were present elsewhere. Conversely, if the antigen was valueless the experiment demonstrated the extent to which natural healing may take place. In any case the experiment demonstrates that fibrosis and natural healing may occur in guinea-pigs affected with tubercle bacillus without treatment of any kind.

Experiment 2.—Attempt was made to immunize twelve guinea-pigs by giving them weekly injections of antigen for five weeks. At the end of this time 4 died, but the 8 survivors, with 6 controls, were inoculated subcutaneously with a culture of human tubercle bacillus. After an interval of a month treatment was continued at weekly intervals for six weeks, by which time four more had died. The remaining four were given two further large injections and allowed to die naturally or were killed when moribund.

There is very little difference between treated and untreated animals as regards weight and length of life. If anything, the treated animals were affected adversely by the antigen; on the other hand, the two last massive doses of antigen produced no immediate response. The postmortem lesions demonstrated how widely individual guinea-pigs may vary in their response to infection with tubercle bacilli. Despite the uniformity of infection, a wide diversity of lesions occurred in both treated and untreated pigs. One of the untreated ones in this experiment had small fibrosed glands similar to those described in two treated pigs in Experiment 1.

Experiment 3.—Thirty guinea-pigs were inoculated with human tubercle bacillus and divided into three batches of ten. One batch was treated with diaplyte antigen, another with bacillary emulsion (tuberculin), and the third not at all. The experiment had only lasted three weeks at the time of writing. Untreated pigs gave best results, diaplyte antigen the worst; at the end of twelve weeks three animals of the diaplyte series were alive, six of the tuberculin series, and seven of the untreated. Among those which had died no absolute differences between the treated and untreated could be distinguished.

General Conclusions.—(1) The evidence which is usually brought forward in demonstration of the cure of tuberculosis in guinea-pigs is invalid, because: (*a*) Such indications of healing as have been described occur naturally in untreated animals; (*b*) they do not indicate increased resistance to the tubercle bacillus in the animal itself, for they are local manifestations, and are associated with the progress of the disease elsewhere in the body.

(2) The original observations in support of Dreyer's treatment are, in the absence of adequate controls, quite inconclusive.

(3) In the author's experiments it has not been possible to demonstrate any curative action of the diaplyte vaccine.

(4) There is a good deal to suggest that the antigen had an adverse action on the guinea-pigs treated with it, even in comparison with tuberculin.

(5) It is possible that different and more favourable results might have been obtained by more careful dosage, but this is supposition.

H. M. J. P.

Sopravvivenza decennale di alcuni microbi del gruppo tifo-coli in liquidi organici. (Decennial Survival of Bacteria of the Coli-typhoid Group in Organic Fluids.) By V. Puntoni. (*Ann. d'ig.*, 1920, 33, 156, and *Medical Science* Abstracts and Reviews, vol. ix, No. 2, November, 1923, 169).—Two tubes of blood serum, which had been inoculated with *Bacillus paratyphosus* A and *B. paratyphosus* B, and then sealed in the flame, were opened ten and twelve years afterwards. It was found that they contained living germs, and that these still possessed the same characteristics and virulence as noted so many years before. The fact that no excessive multiplication of germs had taken place in the sealed tubes is attributed by the author to the small, and perhaps steadily diminishing, quantity of oxygen which they contained. This observation might explain certain so-far obscure epidemiological phenomena, and suggests a simple method for keeping unaltered for years strains of non-spore-bearing bacteria.

The Pathogenesis of Primary Pneumococcal Peritonitis.—By J. E. M'Cartney, M.D. (from the *Journ. of Pathol. and Bacteriol.*, vol. xxvi, No. 4).—Primary pneumococcal peritonitis, essentially a disease of childhood, consists in a primary infection of the peritoneum with pneumococcus, no signs of infection being present in the chest or elsewhere, and peritonitis being the sole lesion discovered on autopsy.

There are three theories as to the route of infection, viz.: (*a*) by the blood-stream, (*b*) through the bowel wall, and (*c*) by way of the genital tract in the female. The author investigates the latter hypothesis, noting that in the literature not a single undoubted primary case occurring in a boy is recorded.

Ten cases were examined, the material for investigation being collected at the operation and at other times from (1) upper portion of the peritoneal

cavity; (2) pouch of Douglas; (3) vagina; (4) throat; (5) blood; (6) urine. The usual methods were used to isolate the pneumococcus, which was then subjected to the customary tests of identification and grouped with Rockefeller serum. Three of the eight fatal cases of the series were examined post mortem.

In eight of the ten cases the pneumococcus causing peritonitis was Type I, in the other two Type II. In every case a similar organism was isolated from the vagina. In only five cases was the corresponding organism isolated from the throat, and in two from the urine.

The autopsies on three cases revealed little except that the pneumococcus in its passage upwards from the vagina does not exert any pathogenic action until it emerges from the Fallopian tube. No evidence was forthcoming to support the theory that the infection comes from the intestinal tract, or by the blood-stream from other pneumococcal lesions.

Control observations on the vaginal secretion of 150 children were made, and resulted in the frequent isolation of the pneumococcus, generally however of Type IV. The vaginal secretion of such children with vaginitis, who were badly-cared-for children, was neutral or faintly alkaline in reaction, and not acid as under normal circumstances. The pneumococcus was never demonstrated in the vagina of well-cared-for children.

Vaginal infection is supposed to result from direct infection incurred by children, whose nether regions are inadequately clad, sitting upon door-steps, etc., on which their elders are prone to expectorate; or alternately from fingering of the vulva with soiled hands.

Attempts were made to infect young female rabbits by intravenous inoculation, by feeding, by inoculation via the scarified vagina, and by inoculation into the normal vagina. For this purpose three strains of virulent pneumococci were used, one originating from a case of acute lobar pneumonia, the other two from two cases of the present series. These experiments were unsatisfactory, as the animals either died of septicæmia before peritonitis had time to develop or were unaffected.

Three young female monkeys were then obtained, and pneumococci were injected intravaginally into these. One died of an intercurrent infection, one failed to become infected, but the third developed typical primary pneumococcal peritonitis.

From the investigation the author contends that the following facts emerge:—

(*a*) The hæmatogenic and intestinal theory of infection is untenable.

(*b*) Clinical evidence shows that the disease occurs only in young girls of 3 to 7 years chiefly during the summer months, and in children of the lower classes. Such children frequently have vulvo-vaginitis, and virulent pneumococci may often be isolated from the vaginal discharge. The disease occurs suddenly in otherwise healthy children, and laparotomy shows that it originates in the pelvis.

(*c*) Bacteriological evidence shows the presence in the vagina of an

organism corresponding to that causing the peritonitis, whilst in the throat such was not always the case. Post mortem, no lesion other than peritonitis was found.

(*d*) Animal inoculation shows that the disease can be produced in young female monkeys by vaginal inoculation with pneumococci.

Conclusion is drawn that the vagina is the route of infection in primary pneumococcal peritonitis.

A Simple Modification of Hogyes' Dilution Method of Preparing Antirabic Treatment. By T. F. Sellers (*Amer. Journ. of Public Health*, vol. xiii, October 10, 1923, p. 813).—The use of diluted unattenuated fresh fixed virus was introduced by Ferran in 1888, but the following year Boreggi had five fatal cases with this method, which, as a result, came into disrepute. In 1897 Hogyes used considerably higher dilutions without untoward results and in 1922 the Georgia State Board of Health adopted his method with certain modifications, and after extensive animal tests. The advantages claimed are that less local reaction is produced and the technique of preparation is much more simple than that of any other method yet described while the results are equally satisfactory. Since the method was adopted 3,080 cases (of which 1,075 were known to have been bitten by dogs diagnosed as positive by laboratory examination) have been treated with no deaths. Rabbits are inoculated with an old strain of fixed virus which has been passed through not less than fifty rabbits and the brain is removed on the seventh day during the paralytic stage of the disease. It is ground up with 20 per cent glycerine and 0·5 per cent phenol, and two dilutions are prepared, one of 1 in 2,500 which is called Dilution No. 1, the other of 1 in 1,500, known as Dilution No. 2. Tests for contamination are performed and any samples found contaminated are discarded as are also all rabbits with delayed reaction to the virus. Two forms of treatment are employed. The mild treatment receives one dose of four cubic centimetres of Dilution No 1 and on each of the following ten days two cubic centimetres of the same dilution. On each of ten days after this two cubic centimetres of Dilution No. 2 is given. The intensive treatment is the same as the mild treatment, except that the first eleven doses are duplicated about six hours after the first injection each day. After this, two cubic centimetres of Dilution No. 2 are given daily as in the mild treatment. The size of the dose should be reduced in accordance with the following table :

Body weight of patient		Dose
0—25 lb.	..	0·5 c.c.
25—50 lb.	..	1·0 c.c.
50—75 lb.	..	1·5 c.c.
75 and above	..	2·0 c.c.

A Medium for the Inhibition of Spreaders and the Differentiation of Bacillus coli and Bacillus aerogenes. By C. E. Skinner and T. J. Murray (*Proc. Soc. Exp. Biol. and Med.*, xxi, January 4, 1924, p. 188).—The medium described is Levine's eosin methylene blue agar to which is added 1/100,000 of crystal violet. Out of fifty spore forms (spreaders) inoculated on this medium, none developed in twenty-four hours and twenty-one developed slightly in forty-eight hours. The remainder never developed. No deleterious effects were shown on bacilli of the colon group. The B. *coli* and *B. aerogenes* colonies are very typical in forty-eight hours. *B. coli* colonies are black or dark bluish violet by transmitted or reflected light, with dark centres reaching to the edge or nearly so. They tend to show a decided green metallic sheen. They show no tendency to run together. *B. aerogenes* colonies are pink or light lavender by reflected light; by transmitted light, dark centres not reaching more than half way to the edge. The colonies are sticky, showing a decided tendency to run together. There is no metallic sheen. Out of 235 colonies classified according to this test as *B. coli* 222 or 94·4 per cent were shown to be actually *B. coli* by the Voges-Proskauer test. Out of 99 colonies classified as *B. aerogenes* 92 or 93 per cent were confirmed.

Preventive Vaccination against Acute Koch-Weeks Conjunctivitis. By Nicolle, Conseil and Cuénod (*Comp. Rend. Acad. Sci.*, 1923, August 6, vol. clxxvii, No. 6, pp. 382-384).—The authors consider that preventive inoculation against Koch-Weeks conjunctivitis has not received proper consideration in Europe owing to the fact that the type of infection there is so relatively mild. On the other hand, in lands where trachoma is rife Koch-Weeks infection plays such an important part that prophylactic measures against it are of great importance. Both subcutaneous and subconjunctival vaccinations were employed, and the patients were then subjected to the instillation into the conjunctival sac of fresh cultivations of the Koch-Weeks bacillus without any serious symptoms supervening; whilst a control case showed typical infection. To those of us who know the havoc wrought by mixed infections in trachomatous patients, these observations must seem to be of very great importance.

Vaccine Therapy in Typhoid Fever. By H. Mery and Lucien Girard (*Bulletins et Mémoires Société Médicale des Hôpitaux de Paris*, 3e Série, 40e année, No. 4, February 7, 1924).—Great care must be exercised in the administration of curative vaccines in typhoid fever, especially in children, and they should never be employed in collapsed cases.

There is such a thing as vaccine shock.

The authors used the ordinary vaccine prepared at the Pasteur Institute, killed by heat and titrated so that 1 cubic centimetre contained, approximately, 180 million bacilli; ¼ to ½ cubic centimetre of this was the dose given.

The subcutaneous route was invariably adopted, and the authors are convinced that this is safer and more efficacious than when vaccine is given intravenously.

The great point to be insisted on is that the treatment should be carried out in the first ten to twelve days of the disease: later on, when complications have set in, vaccine therapy is useless and, indeed, may be dangerous.

Using these small doses by the subcutaneous route, and commencing early in the disease, the authors found vaccine therapy to be most successful in the treatment of typhoid fever, both in children and adults

D. H.

Reviews.

"HISTORY OF THE GREAT WAR. MEDICAL SERVICES. GENERAL HISTORY, VOL. II. THE MEDICAL SERVICES ON THE WESTERN FRONT, AND DURING THE OPERATIONS IN FRANCE AND BELGIUM IN 1914 AND 1915." Price £1 1s. Obtainable at His Majesty's Stationery Office, Imperial House, Kingsway, London, W.C.2., or from above through any Bookseller. 1923.

This volume supplies the most valuable modern account of medical administration in war and of the strategical and tactical handling of medical units. The student need no longer turn to Austrian or American works for instruction, as the distinguished author has produced from actual history a narrative which grips the attention from first to last. It is really the evolution of the medical services traced from the commencement of the greatest war the Empire has yet known to the end of 1915.

The illustrations, diagrams, and statistical tables are excellent. The maps in the pocket are good, if perhaps (No. 1 map) rather full of detail for easy deciphering.

In Chapters I to VII are discussed the administration of the medical services on the western front, the medical units in army areas and on the lines of communication and bases; medical services with Allied contingents, special corps, labour corps and Indian contingents; nursing services and medical services for women workers, and the period of concentration.

Chapters IX to XX describe the actual medical preparations for Mons, the retreat, the Aisne, advance and battle, the Flanders front, Neuve Chapelle, Ypres, 1915, Auber's Ridge, Festubert and Loos.

A study of Chapter II shows the necessity for careful training in peace for the actualities of war. It should impress on the purely scientific reader that the ideal army surgeon to achieve the higher ranks should be the officer who is a good administrator as well as a good professional man. Bad administration eventually enhances the suffering of the stricken

soldier quite as much as bad professional treatment. The next chapter deals with army area medical posts, and traces the journey of the wounded man from the front line to the casualty clearing station. Each stage is well described, and valuable details as to selection of sites, etc., are given. Ambulance trains and barges are also discussed, and a brief account of mobile laboratories, sanitary sections and dental centres is included. Apparently the fact that some British divisions improvised their own dental centres has escaped the author's attention. One of the 1914 Expeditionary Force divisions submitted a complete record of eighteen months continuous dental work by two dentists and four mechanics. In this dental centre as many as twenty-seven dentures have been made in a week. The appointment of two dentists per division was sanctioned at the time of the Armistice.

Chapter III deals with lines of communication and base medical units. The chart on p. 67 is well worth careful study, as is also the diagram on p. 87. An error has escaped detection in Chapter IV, p. 102, line 10. According to the "Handbook of the Military Forces in the United States," 1914, p. 88, a brigade consisted of three regiments of three battalions, and not as stated. The unwieldy composition of Indian medical units is shown in Chapter V. It is to be hoped that the lessons of the war will be utilized to produce a modern mobile medical unit for British or Indian soldiers.

The next chapter deals with the medical needs of the various labour corps, and is interesting in showing the peculiar diseases afflicting the different nationalities and the measures for combating them. The nursing services and medical services for women workers are discussed in Chapter VII. The excellent work done as anæsthetists and dietitians is recorded, as is also the calm courage under bombing and shelling for which our nursing services were so noted in the war. A note is made in the succeeding chapter that billeting difficulties render the dispatch of nursing sisters with hospitals inadvisable. They should not arrive until twenty-four hours before their units open. In the same chapter is explained the necessity for the arrival of sanitary sections for bases and concentration areas before the troops, and on p. 181 there is a vivid description of the condition of the bases before the sanitary sections got to work. In fact medical services should arrive at the earliest possible moment, and be established before concentration begins. The failure of certain divisional field medical units to arrive before the advance to Belguim inflicted quite needless hardships on the sick and wounded.

Chapters IX, X and XI are sad but proud reading of heroic efforts by individual officers and men to care for the sick and wounded. The evolution of order and method is discernible in these pages until in Chapter XII the sound arrangements for the advance to the Aisne are fully described. The Aisne battle and the evacuation of casualties with a short account of lines of communication medical services occupies Chapters XIII and

XIV. Chapter XV is entitled the Flanders Front in 1914, and includes a short description of the Antwerp operations. On p. 334 it is stated that one heavy and three Ford ambulance cars were issued to Nos. 1, 2 and 3 field ambulances on December 3, 5 and 9, and that eventually seven ambulance cars replaced seven horsed wagons, three of the cars being light Fords. Surely this is not correct as the First Division received twenty-one Austin touring cars fitted with ambulance bodies in January, 1915. *Two* of these cars only were eventually replaced by Fords in 1916. Chapter XVI describes the first period of trench warfare with the commencement of gas attacks, while Chapters XVII and XVIII deals with the battles of Ypres, 1915, and Neuve Chapelle. The detailed orders on p. 428 of Chapter XIX for the battle of Aubers Ridge, and the modifications for Festubert on p. 439, will well repay close study; as also do pp. 450 to 477 which contain the arrangements for the battle of Loos.

A study of this excellent work clearly shows that at the commencement of operations a more practical knowledge of war administration with greater experience in the handling of medical units would have saved much confusion, discomfort and actual loss of effectives.

The difficulties of training in a corps in which war units do not exist even as cadres in peace can only be surmounted by staff tours, war games, lectures and the study of territorial medical units in training camps. All officers, specialists included, should be encouraged to prepare themselves for war.

A TREATISE ON ORTHOPÆDIC SURGERY. By Royal Whitman, M.D., M.R.C.S., F.A.C.S. Pp. xii + 993. London: Henry Kimpton, 263, High Holborn, W.C., 1924. Price 42s. net.

Consisting of twenty-four chapters, 960 pages, and 877 illustrations, the seventh edition of this book forms a comprehensive treatise on the subject of orthopædic surgery. Much of the matter is, of course, outside the every-day work of the military medical officer, as it deals with ailments and defects not commonly found among the young fit men of a nucleus peace army. The last chapter, however, is of military interest. Entitled "Collateral Orthopædic Surgery," this contains the rules, standards and schedules of physical defects in recruits, showing in detail those defects which do not prevent unconditional acceptance for general military service, those which permit of acceptance for special and limited service, and the defects that necessitate unconditional rejection of the recruit. The weak foot, its causation and treatment, is discussed more particularly.

A schedule of ratings for amputations, fractures and their sequelæ, giving the percentage disability of these, forms part of the same chapter, which also includes an outline of the treatment of fractures, and a comprehensive tabulation showing methods of reduction, immobilization, the position, secondary splinting and physiotherapy required for the treatment of the more common forms of fracture.

The book will be found useful as a work of reference on the shelves of a military medical library. Its interest is enhanced as it deals with the military side of orthopædics from the American experiences of surgery in the Great War. M. B. H. R.

KALA-AZAR. By L. E. Napier, M.R.C.S., L.R.C.P., and E. Muir, M.D., F.R.C.S.Ed. Pp. 160, with many illustrations and charts. Oxford University Press. Price 8s. 6d.

The authors, both of whom are on the staff of the Calcutta School of Tropical Medicine, give a complete and clear exposition of present day knowledge of this disease in all its aspects. In Chapter III the various hypotheses which have been advanced to account for the transmission of the disease are discussed, and the evidence both for and against each theory is tabulated. One point adduced in favour of infection by a blood-sucking insect is the presence of the organism in the peripheral blood of 100 per cent of untreated cases of kala-azar as demonstrated by blood culture. This method of transmission, the authors point out, does not seem to explain the failure to stamp out the disease by burning down coolies' huts and rebuilding them on the same site. Whereas removal of the whole "line" to a distance of 300 yards, together with isolation of the sick and contacts, has proved a generally successful means of checking the spread. Against the indictment of the bed-bug is cited its widespread distribution compared with the localized areas affected by kala-azar. This *per se* is most unconvincing. The distribution of yellow fever, for example, is far from coincident with that of the proven vector, *Aëdes argenteus*.

The laboratory methods of diagnosis are fully discussed. Amongst these the writers attach great importance to the formalin test, performed as follows:—

About five cubic centimetres of blood is withdrawn from a vein, and allowed to stand until the serum separates. To one cubic centimetre of the serum in a test tube, one drop of commercial formalin is added, the tube well shaken and placed in a rack at room temperature. "If the blood is from a well established case of kala-azar, three to four months or more, the serum will immediately become viscid, within a minute or two will have 'set' so that the tube can be inverted without the serum being spilled. . . . Within three to twenty minutes, the time varying in different cases, the whole of the serum will have become absolutely solid and opaque like serum coagulated by heat or the 'white' of a hard boiled egg. . . . This reaction may be taken as absolutely diagnostic of kala-azar." Diseases other than well established kala-azar (three to four months duration, or more) may cause a doubtful serum reaction, but Napier and Muir state that in these conditions the serum is never both solid and absolutely opaque.

This sounds almost too good to be true. It will be interesting to

observe if further experience confirms the reliability attributed to this test by the writers.

The chapter on treatment is excellent. Everything that the beginner requires is included, and the experienced physician may read it with advantage.

Altogether the book makes instructive and most agreeable reading. In discussing their many-sided subject, the authors show broad-minded tolerance, and there is a singular freedom from any trace of didactism which is very pleasing to experience. W. P. MacA.

Magistri Salernitani Nondum Cogniti. A Contribution to the History of the Medical School of Salerno. By Doctor Pietro Capparoni, with a foreword by Sir d'Arcy Power, K.B.E., M.B.Oxon., F.R.C.S.Eng. London: John Bale, Sons and Danielsson. Pp. 68 with coloured frontispiece and 27 plates.

It is to be feared that many who now enjoy the present advances in surgery and medicine give little thought to the early beginnings of that art and science, or to the difficulties and circumstances associated with the preservation of early knowledge in respect of them through the Middle Ages. If this be so, then this ornate volume comes as an elegant corrective to our forgetfulness and as a wholesome reminder to re-orientate our thoughts and ideas.

This book deals with the forgotten worthies of Salerno, to-day a small provincial town in Italy with an archbishop and a lovely Norman cathedral, but, from the eleventh to the fifteenth century a celebrated centre for the study of philosophy and practical medicine, because of the work done there by the Hippocratic method. Few traces remain to-day of its ancient splendour, but for four centuries it was the sanctuary and seminary of the science and art of medicine and surgery. The Roman Empire of the West was the heir to Greek knowledge, and when that Empire fell its gathered treasures of art and science suffered irreparable damage or destruction from the uncultured invading hordes from the north and east of Europe. If a small part escaped it was due to the monastic establishments which arose in the sixth century through the work of St. Benedict of Nursia and of Cassiodorus, and culture was found a home in the cloister. The salvage and preservation of medical codices and other records of early knowledge or experience in surgery and medicine we owe to the Benedictine and Basilian monasteries of the Middle Ages. St. Benedict, who founded his Order in 529, made the corner stones of its Rule to be prayer, study and assistance to the sick. It was, therefore, only a question of time for every monastery to have one or more brethren learned in the care of the afflicted, and a separate place in the cloister where the sick could be treated, while the herb garden which existed in every monastery allowed those instructed in their use to have available the medicinal plants required. In these matters Italy was for four centuries much in advance of France, Germany,

Spain or England, and it was to Italy that the great abbeys of those other countries sent for texts of medical works and doctors. Gradually, every bishopric became a centre of instruction and every ecclesiastic knew something of physic, under which name the medical science of the day was known, but every *clericus* did not necessarily become or work as a *medicus*. In consequence of the practice of medicine by monks in the districts around their monasteries leading to a neglect of their theological duties, it was decided early in the thirteenth century to prohibit the practice of medicine to monks outside their own monasteries. As a result of these prohibitions, lay doctors increased in numbers and began to form corporations, but they all received their knowledge from teachers in the monasteries and episcopal centres.

In this manner there developed gradually centres of medical teaching outside and independent of the monastic houses, though these latter were the original source of their learning. Of the Italian centres Salerno was pre-eminent for centuries, and it alone was entitled to put beneath its arms the motto—*Civitas Hippocratica*. The history and records of the great medical school at Salerno has been exhaustively supplied by the Neapolitan historian De Renzi, but he appears to have overlooked an interesting manuscript in the library of St. Matthew's Cathedral at Salerno. This was discovered in 1916 by Dr. Capparoni when on military duty there, and found it to be the *Liber Confratrum* and an obituary list of the confraternity of the *Cruciati* founded in the Middle Ages. The earliest original entry is of the eleventh century, but there are transcriptions of earlier *chartulæ* which have now disappeared. The lists contain many names of doctors, or men who practised as such, which had escaped record by De Renzi. The volume now issued contains an excellent coloured plate of an old manuscript, with drawings depicting the sick and maimed coming for treatment, also very good photographs of individual pages of the manuscript on which Dr. Capparoni worked, and whose analysis of the names found thereon constitutes the main part of the letterpress. This volume has been issued as No. 2 of the Research Studies in Medical History from the Wellcome Historical Medical Museum in London, to whom and Dr. Capparoni all those interested in the earlier history of medicine owe a debt of gratitude. The publishers too are to be congratulated on the excellent manner in which the book has been produced.

R. H. FIRTH.

Correspondence.

FERMENT-VIRUSES AND PATHOLOGICAL HÆMETABOLY.

TO THE EDITOR OF "THE JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—May I briefly draw attention to two passages noted in papers I have recently seen, which bear, respectively, upon my general theory and upon the special case of the "Rickettsia"-bodies.

In an instructive, critical review of present knowledge relating to *herpes febrilis* and *encephalitis lethargica*, Doerr and Zdansky (*Zs. Hyg.*, 102, April, 1924), write as follows in their concluding remarks (p. 47, *et seq.*): "It appears not impossible that the ultimate true solution of the problem of *encephalitis lethargica* has been wanting hitherto because the microbiologists working thereon have had under consideration in a too one-sided manner a *contagium animatum* as the necessary and sufficient cause of this disease. The reason for this standpoint has lain in the assumption invariably made that an infective agent, transmissible from animal to animal, can only be a living, parasitic organism, a supposition which, however, as Doerr has several times pointed out, is not necessarily in all circumstances right." (The authors do not appear cognizant of my work, and the views I have first enunciated and consistently advocated in this Journal since 1921.)

Doerr and Zdansky refer to certain most interesting *experimental* work by Frey, Fuchs, and Jahnel and Illert, in various directions, to outline which here, however, would occupy too much space. But the observations cited are regarded by the authors, if they are subsequently confirmed, as pointing unmistakably in the direction of a non-living, transmissible virus or *materies morbi,* which would be of the nature of a cytotoxin and might, indeed, be regarded as a ferment, the resulting contagious diseases being an enzyme-infection. (This ferment I have preferred to regard, *on my evidence of abnormal hæmetaboly*, as, primarily, a pathogenic hæmetabolic enzyme, which eventually induces cytolysis also.) The authors even recognize the possibility of a type of process such as I indicated in the case of influenza, where the primary disease may be due to a micro-organism, but its transmission can be subsequently effected by the corresponding cytotoxin (ferment) produced by the injured cells in the course of their dissolution, without the further intervention of the actual organism (cf. JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, vol. xxxix, October, 1922, p. 258). This hypothesis the authors apply to the case of the experimental encephalitoid conditions, as to which I can as yet say nothing. I hope, all being well, to take up the study of the alleged Microsporidian parasite, "*Encephalitozoon*," myself.

Now, as regards the "Rickettsia"-bodies, I quote the following from

a paper by Wolbach and Schlesinger on the cultivation of the micro-organisms of Rocky Mountain spotted fever and typhus fever in tissue-cultures (*Journ. Med. Research,* xliv, December, 1923, p. 254): "The number of infected [endothelial] cells in all cultures has been disappointingly small. It is evident that cells containing the micro-organisms [i.e., the "Rickettsias"] die, and yet we have been unable to obtain any evidence that the organisms multiplied or even persisted in the plasma. There seems to be no mechanism for the passage of the micro-organism from cell to cell, and we are forced to the conclusion that the cells containing the micro-organisms in tissue-cultures are cells originally infected in the animal body, or descendants of such cells." Well, in the first place, since the cells containing the organisms die (as a result of their infection with the parasites), it seems extremely unlikely that they (the cells) thrive and multiply, and give rise to fresh descendants! Again, what a hopeless kind of organism this "Rickettsia" must be! Has anyone ever heard of such a microbe, unable to spread from one cell to another and maintain and propagate itself, given the presence of its susceptible host-cells?[1] Really, I think further comment is unnecessary. Scarcely anything could more strikingly indicate that the alleged organisms are merely products of abnormal endothelial cell-metabolism! For some reason, *under the conditions prevailing in the artificial culture,* either the pathogenic enzyme is neutralized or destroyed extra-cellularly, or else the cells can obtain no blood-elements to metabolize in the particular abnormal manner, with further production of "Rickettsia"-bodies.

May 20, 1924.

I am, Sir, etc.,
H. M. Woodcock.

TREATMENT OF MALARIA.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Sir,—A proprietary preparation of foreign origin has been vaunted of late as a specific in malaria infections. Medical officers recently returned from abroad have cited cases of malaria resistant to ordinary quinine-iron-arsenic treatment, which yielded in a most gratifying manner to a course of this secret remedy. The other day a lady patient told me of its miraculous effect in "curing" her own infection in India. Her persistent relapses of malaria since returning to England have left this touching faith unshaken.

A quantity of this preparation submitted to the Hygiene Department, Royal Army Medical College, for analysis, is reported on as under:—

"The pills were coated with a black layer and weighed on an average 0·293 gramme each.

---

[1] The *normal* cells lived all right in the cultures.

The results of the chemical analysis of the whole pill were as follows:—

Quinine acid sulphate	...	55 to 60 per cent.
Ferric citric ...	...	20 to 25 ,,
Arsenic (as oxide)	...	0·13 ,,
Sugar	...	12 ,,
Moisture ...	...	6·25 ,,

I am unable to determine the composition of the remaining few per cent of material."

As regards the concluding sentence of the report it should be mentioned that the pills could not be freed completely from the gummous coating, which is included in the analysis in consequence.

In the course of a well known and moving scene, the Lord Romeo Montague contended that a rose is unaffected by any change in nomenclature. However true this may be for the vegetable kingdom, his observation cannot be applied to medical therapeutics, for a combination of quinine, iron and arsenic, called by some other name appears to become infinitely more effective.

I am, etc.,
W. P. MacArthur,
Brevet Lieutenant-Colonel R.A.M.C.

Royal Army Medical College,
April 3, 1924.

THE EFFECT OF CHEMICAL WARFARE ON MEDICAL ADMINISTRATION.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Sir,—Reading Major M. B. H. Ritchie's article in the April number of our Journal, I was struck by his suggestion of enlarging the scope of our training, as a Corps, by correspondence classes. I am one of those who were prevented by force of circumstances from obtaining any first-hand information of Medical Administration in War upon the Western Front, but I have a good knowledge of Chemical Warfare and its problems. I should be very glad if you would publish this letter. I hope it may strike the eye of someone who is not too much afflicted with "post bellum rest" and that we may obtain mutual benefit by, say, tackling some of the problems recently published in our Journal from the point of view of Chemical Warfare and its consequent effect upon Medical Administration. If anyone so inclined would write to me at the address below I would be glad to discuss ways and means.

I am, etc.,
H. S. Blackmore,
Major, R.A.M.C.

Experimental Station,
Porton, Wilts.
May 3, 1924.

INDEX TO VOLUME XLII.

C.N. = Clinical and other Notes.
C.L. = Current Literature.

Notices.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts, and commands at home and abroad.

All such Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notified at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

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Any demand for *reprints, additional to the above*, or for excerpts must be forwarded at the time of submission of the article for publication.

Matter intended for the Corps News should reach the Editor not later than the 15th of each month for the following month's issue. Notices of Births, Marriages, and Deaths are inserted free of charge to subscribers. All these communications should be written upon one side of the paper only; they should by preference be type-written; but, if not, all proper names should be written in capital letters (or printed) to avoid mistakes, and be addressed: The Editor, "Journal of the Royal Army Medical Corps," War Office, Whitehall, S.W.1.

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